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TABLE OF CONTENTS.

ENGINEERING NEWS OF THE WEEK....459, 473
Enlarging a Tunnel in Soft Ground (illustrated). 460
The Organization and Work of a Street Department 469
Experts' Report on the Lancaster Reservoir Failure 462
The Moore Trench Machine (with inset)..... 463
The Maximum Practicable Span for Suspension Bridges (concluded) 463
The Tinker Storm Window (illustrated)..... 465
Failure of a Building at Montreal, Canada..... 465
Explosion of a Cast Iron Steam-Heating Boiler.. 466
Organization and Management of a City Engineer's Office 470
Recent Experience with the M. C. B. Coupler.. 471
Utilization of the Railway Scrap Pile..... 472

PERSONALS, NEW PUBLICATIONS, SOCIETY PROCEEDINGS 466, 467

EDITORIAL NOTES 468
The Lancaster Reservoir Failure—The New Am. Soc. C. E. Badges—A Needed Reform in the Distribution of Public Documents.

EDITORIAL:
Organization of a City Engineer's Office..... 468

LETTERS TO THE EDITOR..... 469
Organization of a City Engineer's Office—Two Specimens of "Economical" Bridge Construction—The "Economy" of Good Foundations for Paving.

CONSTRUCTION NEWS 473
Railways, Street and Electric Railways, Elevated Railways, Highways, Bridges, Water-Works, Artesian Wells, Irrigation, Sewers, Streets, Electric Light and Power, Garbage Disposal, Miscellaneous Contracts and Supplies, Condensed List of Contracts Pending with Date of Opening Bids, Contract Prices, Metal Market Prices.

INDUSTRIAL NOTES 478

Proposals for three torpedo-boats will be asked for in a few days by the U. S. Navy Department. They will be 150 ft. long, 16 ft. beam, 5 ft. draft, 2,000 HP. and measure 138 tons, with an average speed of 24½ knots. There will be no premium for excess speed, but a penalty of $10,000 per knot for deficiency, and the boats may be rejected if the speed falls below 23 knots. The boats are to be delivered completely equipped with small boats, furniture, electric light plant, and everything, excepting ordnance and sea stores.

The effect of garbage-dumping upon fishing grounds forms a part of the report to the Mayor by the New York Garbage Commission. The general conclusion reached is that the more desirable varieties of fish avoid garbage or offal of any kind, and are driven away by it, and fishing grounds are thus spoiled. The presence of garbage also destroys shell fish and spoils the flavor of lobsters. Ex-Fish Commissioner E. G. Blackford says that an immediate and valuable effect of stopping local garbage-dumping and otherwise disposing of it will be to make the waters of our lower harbor and outside of Long Island more inviting to the better class of fish than at present.

The actual present status of the Nicaragua Canal project, and of legislation upon it, is of general interest at present, and can be briefly stated as follows: At the last session of Congress a bill was unanimously reported from the House Committee on Commerce authorizing the Government to issue $70,000,000 in 30-year 5% bonds. It was proposed to pay to the Maritime Canal Co. $3,500,000 in stock for the concessions obtained by it from Nicaragua and Costa Rica, and to reimburse the Nicaragua Canal Construction Co. in stock for the sums actually expended by it upon the canal. The governments of Nicaragua and Costa Rica were also to receive in the new stock the amounts guaranteed to them by the Maritime Canal Co. The remainder of the stock would be held by the U. S. Government. The management of the canal was delegated to a board of 11 directors, eight representing the United States and one each the governments of Nicaragua and Costa Rica and the Maritime Co. The House seemed favorable inclined towards the bill, but Speaker Crisp objected to it, and it was not presented. Within the last two years the Nicaragua Canal Construction Co. has become financially embarrassed, and finally was placed in a receiver's hands, and all work was stopped. A reorganization committee was formed and all the old stock, excepting about 1,200 shares out of 120,000, was turned over to the committee, together with an assessment sufficient to pay some debts and provide current funds. A committee then visited Europe in an effort to interest capital there, and is said to have had encouraging success. The reorganization committee has secured a new charter from the Vermont legislature granting the company even wider powers than were given by the old charter. The prospects for national legislation in aid of the enterprise, either in this or the succeeding Congress, seem very bright, especially in the light of the late diplomatic imbroglio at Bluefields.

A large section of made land forming railway yards and steamship wharves at Tacoma, Wash., slid into Puget Sound, Nov. 28, destroying docks, freight sheds and the pump house of the hydraulic filling of the tide lands. The length of the strip which caved in is about 1,400 ft., and the damage done extends back in places 100 ft. The report that the catastrophe was caused by a tidal wave is said to be borne out by facts. The ground is filled in, and composed of loose rock, earth and material of all kinds. This has never had anything to brace it or hold it in place, and the recent heavy rains have undermined it, causing it to slide forward into the bay when disturbed by the pressure of the wave.

The most serious railway accident of the week was a derailment on the Delaware & Hudson R. R., near Port Henry, N. Y., Dec. 3. The tender of a south-bound express train from Montreal left the track and was followed by the mail and express car, baggage car and smoking car. The first two cars went down the bank into Lake Champlain, and the express messenger and mail clerk were drowned. Four men were injured. On Dec. 2 a light engine following a coal train on the Central R. R. of New Jersey ran into the rear of the train, which had been stopped at a grade crossing. The engineman and fireman were killed, and the conductor of the freight train was badly burned, the caboose being destroyed by fire.——A grade crossing collision occurred at Hartford, Conn., Nov. 29, a passenger train on the Valley Division of the New York, New Haven & Hartford R. R. striking a switch engine of the New York & New England R. R., overturning the latter and killing the engineman. The engineman of the passenger train claims that the signal gave him the right of way, but was changed just as he reached it, while the fireman of the switch engine claims that the signal was set for that engine. ——A passenger train on the South Carolina & Georgia Ry. was derailed by wreckers near Kingsville, S. C. The cars caught fire and were destroyed, together with the mail and express matter.

A road crossing accident occurred at Central St., Southbridge, Mass., Nov. 29, by which two persons were killed outright and 14 were seriously injured, two of the latter dying a few days later. The vehicle struck was a large omnibus containing a party of football players. The crossing is said to be a dangerous one.

A dynamite storehouse at the Repanno Chemical Works, La Motte, Pike county, Mo., was blown up on Dec. 2, killing one man. The explosion was so severe that it was heard 20 miles away, but none of the other buildings of the works was damaged.

A broken driving-wheel derailed the engine of a passenger train on the Ansonia branch of the New York, New Haven & Hartford R. R. on Dec. 3. The accident occurred on a trestle over the Naugatuck River and the engine and two cars were derailed and ran for some distance on the ties, but did not leave the trestle or turn over.

A horizontal boiler in a sawmill at Greene, R. I., burst on Dec. 3, killing two men and seriously injuring three others.

The boiler of a traction engine employed to run a portable sawmill at Danby, N. Y., exploded Nov. 26. Two men were killed and two probably fatally injured.

Explosions of dynamite while being thawed out are becoming more frequent as the cold weather sets in. The latest accident of this kind occurred Dec. 4 at Hull, Que., on the water-works extension, at Duke and Wall Sts. Two boxes, containing 40 lbs. of dynamite each, exploded. The dynamite was used for blasting purposes and was stored in a small cabin, in which was a small tin stove, with a fire for the purpose of thawing out the explosive. Four men were standing near the cabin when one discovered it to be on fire, and immediately rushed to extinguish the flames. He was about to open the door when the explosion took place. Five persons were killed.

By the explosion of 120 lbs. of fulminate of mercury in a powder-house of the Waterbury Brass Co., at Waterbury, Conn., Nov. 27, a powder-maker who was in the building was blown to pieces. The fulminate was used by the company in the manufacture of primers for cartridges, and was made in a small building in a vacant lot, 1,000 ft. south of the factory. It was within a short distance of the center of the city, and the explosion destroyed several thousand dollars' worth of glass.

An electric storage battery placed in each car of the Jersey City line of the Newark Traction Co., crossing the Newark meadows, is used as an adjunct in lighting the cars. Under the former system in use, the slipping of the pole from the trolley wire at once put out the incandescent lamps, and left the passengers in the dark. When this happens now, the storage battery at once comes into play and lights two lamps.

The torpedo-boat "Ericsson" again broke down in a machinery trial trip on Nov. 30. This time it was the low-pressure piston rod that gave way, wrecking the low-pressure cylinder and necessitating a long delay for repairs. The boat was said to be making about 25 knots per hour when the accident occurred.

The grade-crossing problem in Buffalo is making some progress toward solution. The statement has been published that the commissioners have reached an agreement with the New York Central with reference to the basis on which the work is to be done. The New York, Lake Erie & Western and Western New York & Pennsylvania companies, however, are strenuously opposing the work. The Erie attorneys at a recent hearing declared that the cost of the work to be done by that road would be excessive and greater than the road could bear.

The first 15 miles of the new Hennepin Canal will be open for navigation purposes next spring. This includes 5 miles at its junction with the Mississippi River, upon which 3½ years of work have been expended in passing the Rock Rapids. Water was let into this section on Nov. 28, and with the 10 miles of slack-water navigation above it, created by this work, there are 15 miles available for navigation purposes.

An interesting job of submerged pipe-laying is being done at Detroit, Mich., where two parallel lines of 8-in. gas main, about 2,800 ft. long, are being pulled across the Detroit River by means of four locomotives on the Canadian shore, attached to the pipe by a wire cable. One line of pipe was completed on Nov. 21, and it was expected that the other would be started on Dec. 3. The pipe is joined in sections of some 500 ft. on the American shore, and launched through a trench lined with boards. Extra heavy wrought iron pipe is used, with a Heckenbourgh joint. At intervals of about 500 ft. the pipe is buoyed up by lighters, to prevent burying too deep in the mud while being drawn across. The pipe is being laid by the Interior Construction & Improvement Co. to bring in natural gas from Canada. Mr. F. P. Byrne is vice-president and manager of the company, and Mr. Jas. H. Stanton, of Buffalo, is in direct charge of the pipelaying, Mr. Stanton having laid pipe in a similar manner beneath the Niagara River at Buffalo. We are indebted to Mr. Byrne for the above information.

At a meeting of English cement manufacturers, held in London, on Nov. 16, an anti-adulteration association was formed. Each member of the association must first sign a declaration on oath, through its managing partner and resident manager, to the effect that his firm or company has not during the last three years, or at any other time, added to the calcined products of the kiln, at any time during the process of manufacture, a separate supply of "raw kentish rag-stone, other stone, furnace or oven ashes, disused or exhausted fire-bricks, or any other material, so that such added material would be ground, sifted, or mixed together with the cement powder," and be sold as pure cement.

Later information concerning the recently organized Association of English Cement Manufacturers shows a strong opposition to it, in its present form. The avowed purpose of the association was the maintenance of the integrity of Portland cement, and the members of the association were required to declare upon oath that they had not and did not use certain named materials as adulterations. Of the two parties present at the meeting, says "Engineering," one maintained that cement should be made from chalk and clay alone, without other admixtures, as had been the practice in years past. The other and progressive party declared that it was unscientific to suppose that the manufacture of cement could not be improved; and one party claimed that the admixture of Kentish rag-stone, forbidden in the association declaration, improved the cement in color, in tensile strength, and in the sand tests, and gave results to prove his assertion. Other speakers advocated following the rules of the German association, permitting the addition of 2% of foreign material in the manufacture of Portland cement, as this rule would give sufficient latitude to those who claimed that the addition of certain ingredients would improve the quality of the cement. The whole matter was finally referred, by resolution, to the cement trade section of the London Chamber of Commerce, and the body has appointed a committee to report and advise upon the subject.

ENLARGING A TUNNEL IN SOFT GROUND.

There is now in progress on the line of the Boston, Revere Beach & Lynn R. R. in the city of Boston, Mass., a unique and difficult work in soft ground tunneling, which is of especial interest at this time, when the matter of elevating or depressing railway tracks in our cities is assuming such importance. The work consists in replacing an old single-track tunnel built for narrow gage cars and used by a heavy suburban traffic, by two single-track tunnels, side by side, one being a reconstruction of the old tunnel with enlarged section and each being large enough for full size standard gage rolling stock.

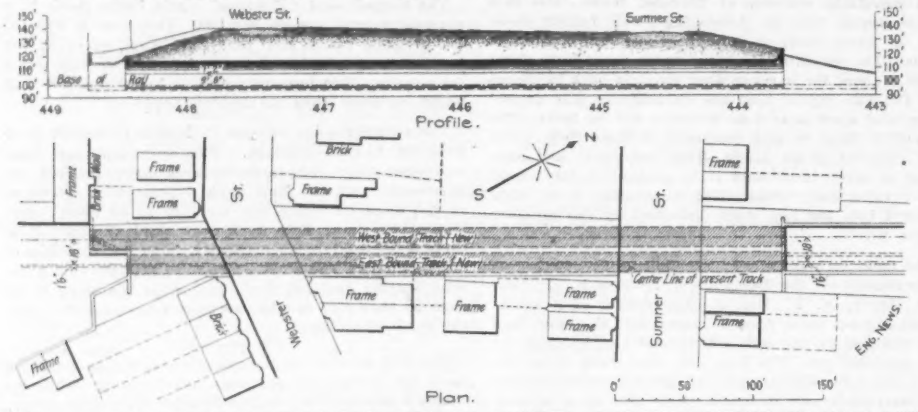


FIG. 1. PLAN AND PROFILE OF EAST BOSTON TUNNEL, BOSTON, REVERE BEACH & LYNN R. R; G. M. Tompson, M. Am. Soc. C. E., Engineer.

This railway was put in operation in the summer of 1875, and is of 3-ft. gage. The old tunnel, according to Drinker's "Tunneling," was 471 ft. long, on a tangent, with a grade of 11.2 ft. per mile. It was 12¼ ft. wide and 14 ft. high in the clear, and was built through clayey hardpan from two 35-ft. temporary shafts. The work was done by day labor, under the direction of Mr. A. B. Blake, then President of the road, and no explosives were used.

From an inspection of the old tunnel by a member of the staff of this journal, and from the precautions which have been taken to protect it during the improvements, it appears that the original tunnel was in bad shape when its reconstruction and enlargement were determined upon. The tunnel lining is badly deformed in many places, and some cracks are apparent. Some time ago the officers of the railway company consulted Mr. Geo. M. Tompson, M. Am. Soc. C. E., with reference to these defects, and after a careful examination the plan of reconstruction described below was recommended and adopted. Mr. Tompson was engaged as Chief Engineer of the work, and the contract was let to W. P. Kennedy & Co., of Binghamton, N. Y. We are indebted to Mr. Tompson for the information from which this article has been prepared and for the drawings accompanying it. The difficulties of the construction may be understood by referring to the plan and profile, Fig. 1, which show the buildings and streets along the line of the tunnel and the small depth of cover over its roof. The softness of the material through which the tunnel had to be driven may be appreciated by examining the extent to which the three-ring brick lining of the old tunnel had been squeezed out of shape; and it will be remembered that carrying on the work without interrupting traffic was a paramount necessity.

It was decided to first drive the north tunnel parallel to the existing tunnel and close beside it, and after its completion to turn the traffic through it while rebuilding the old tunnel. It is believed that the driving of the north tunnel so close to the existing tunnel, while the latter was in use, is a feat which has not been surpassed in soft ground tunneling.

To insure the safety of the old tunnel during the progress of the work, it was braced up in advance of the drifts on the new work, as shown by Fig. 2; this bracing being done in the night to avoid interruptions to traffic. The old rails used as ribs were bent at a forge works near by. The upper sections were raised to position by a hydraulic jack placed on a flat car, two men holding each section in place while it was being bolted by means of fish-plates to the leg-sections below. The whole form was then lowered to bearings and lagging was driven in to fill the space overhead. Longitudinal timbers and cross-bracing of 12 × 12-in. stuff were used as shown in the sections. The cross-section, Fig. 2, is taken at Station 447 + 49.15, the sections varying with the deformation of the tunnel at different points. In some places there was not sufficient room in the clearance space to put in the rail bracing without sinking it into the brick.

The new tunnel, to run alongside the old one, was begun from shafts sunk a few feet from each end. The material encountered was badly ruptured, either through original disturbance, when the old tunnel was driven, or the subsequent settling caused by defective work in filling around the arch of the old tunnel. This necessitated the heavy timbering shown in Fig. 3, which also shows the method of drifting employed.

The work was carried on with two 10-hour shifts at each end. Work was started at each end at the top of the high side drift, Fig. 3, and was carried down 3 or 4 ft., by driving sheeting and poling boards. The short temporary timber shown in Fig. 3 was put in, and then the drift was closed with a bulkhead to prevent caving. This being done, the excavation in this drift was carried down to a point just below the base of the rail and the long side timber was set. After the work was well started the north drift was kept in advance in each heading. Dirt from the top central drift was thrown down into the upper side drift. The timbering was spaced 3 ft. c. to c., along the tunnel, spacings of 5 and 4 ft. having been tried successively and found impracticable. With this close spacing, however, the pressure on the timbers was so light that they could be used over and over.

Backfilling and packing were done with the material at hand, except where it was considered necessary to use concrete near the foundations of buildings.

By referring to Fig. 1 it will be seen that the tunnel passes about at right angles beneath two streets. The sewers in these streets, which were of brick, were found broken and leaking. The railway company dug down 18 ft. to these sewers and replaced them temporarily with 24-in. cast iron pipe, suspended from timbers laid across the trench. These pipes extended about 100 ft. each side of the tunnel. Water mains 8 ins. in diameter and gas pipes were also suspended in the same manner.

In driving the new tunnel, the earth in the center was left in place until the roof arch was entirely completed. In rebuilding the old tunnel it is necessary to construct a timber center platform to take the place of this earth core, as shown by the section, Fig. 4. Mr. Tompson proposes in his work on the old tunnel to run a drift over the old lining all the way and break through the arch from above.

The section of the double tunnel, as completed, is shown by Fig. 5, in which the centering for the brick arch may also be seen. The old lining consisted of only three rings of brick, while the new lining is five rings thick.

The north tunnel is now completed and all the trains are running through it, while work is in progress on the reconstruction of the old tunnel beside it. Mr. John A. Fenno is the Superintendent of the Boston, Revere Beach & Lynn R. R.

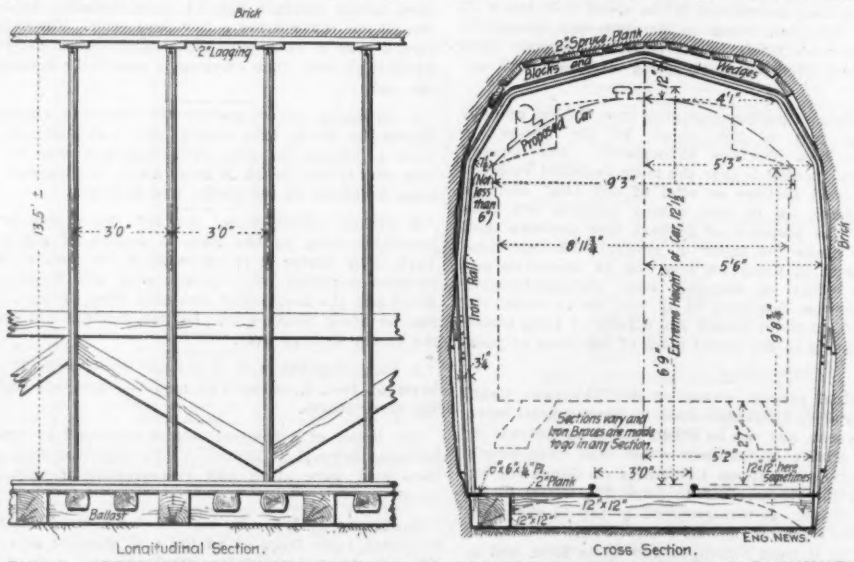


FIG. 2. SECTIONS SHOWING METHOD OF TEMPORARY BRACING OF OLD TUNNEL.

THE ORGANIZATION AND WORK OF A STREET DEPARTMENT.

In the final report of Mr. W. S. Bacot, M. Am. Soc. C. E., upon a system of street improvement for the city of Burlington, Vt., particular attention has been called to the necessity of a proper organization of a street department to secure good and economical work. As the present defective organization of the street department in that city is similar to that of many other cities, and as the question of proper control of municipal public works is of growing importance, we print below some extracts from the report above referred to, which was submitted to the Mayor and the Board of Street Commissioners of Burlington in October:

The consummation of this extensive work of street improvement, contemplating the construction of nearly 40 miles of practically perfect street pavements, cannot be expected under from five to ten years, according to the way in which you go about it. Deducting the asphalt pavement from the summary, we have left about 37 miles of all other classes of pavements, costing about $350,000, or an average of about $9,500 per mile. Supposing a proportional mileage of each class to be built annually, the proposed limited appropriation of $20,000 would only turn out two miles yearly, and at this rate the end would not be reached for about 18 years, at which time the mileage of city

street would very likely be increased one-third, and the end will still not be in sight.

On the other hand, the ability of the street department to handle the expenditure of any more than that amount per annum with profit may well be questioned, if the record of the past season is worth anything; while, at the same time, it is positively certain that the construction of anything less than five miles of permanent improvements, involving an annual outlay

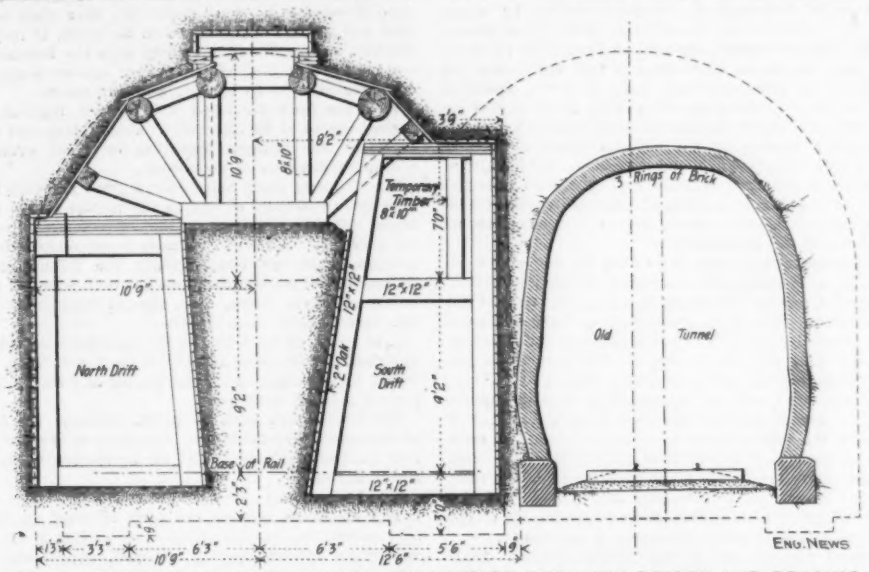


FIG. 3. SECTION OF NEW TUNNEL EXCAVATION SHOWING DRIFTS AND BRACING.

of at least $50,000, will not be satisfactory to the citizens of Burlington, and it is doubtful whether it will be tolerated under any circumstances. Even at that rate two years will have elapsed before the results of the $100,000 appropriated may be enjoyed, and seven years before the whole job is complete. This means tripling the performance of the street department during the past season; and this in turn means that the work will either have to be done by contract, leaving the street department to attend solely to its proper and, in the past, palpably neglected duties of maintenance of streets, or else that the department must be reorganized, reinforced and equipped in such a manner as to make it efficient both in its engineering and executive functions.

I desire to place this matter squarely before you in a business light, as well as from a professional stand-

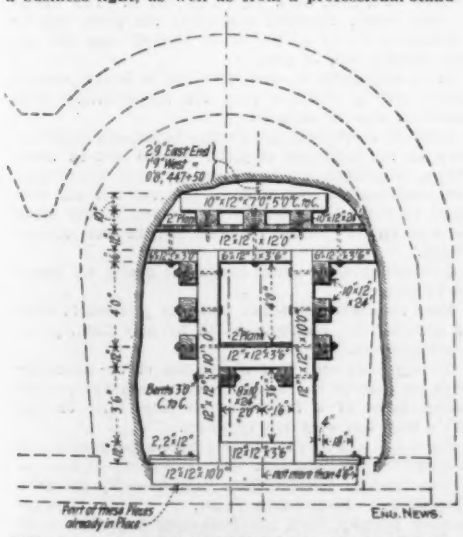


FIG. 4. SECTION SHOWING TIMBER CORE USED IN REBUILDING OLD TUNNEL.

point. You will, therefore, kindly consider my remarks as devoid of any personality or political significance whatsoever, and quite free of any force adverse to persons or parties. As my mission has been to correct rather than to criticise methods, I shall not dwell in detail on the weak points in your street department. The past season's close association with the department convinces me, however, that it needs early and thorough reorganization, not only to carry on successfully and conservatively the new work projected, but even to compass the daily care and maintenance of the city streets which properly devolves upon it.

The present make-up of your street department allots the administrative duties to your Board of Street Commissioners, who are responsible directly to your Board of Aldermen; the executive duties devolve upon your Superintendent of Streets, who takes his orders from your said Board of Commissioners. The engineering faculty resides indefinitely, by a sort of obsolete usage, in your Street Commissioners, your Superintendent of Streets and your City Engineer. The last-mentioned official, the only one who by any possibility might be expected to be competent to determine engineering questions, unfortunately exercises no control over public works. He is supposed to take no cognizance of anything but lines and grades and measurement of work done, pays no attention to constructive engineering, and is paid accordingly.

At times even your Board of Aldermen may be heard discussing problems exclusively the property of the engineer; thus we have four separate branches of your city government handling its engineering concerns, while in no one of them is competent engineering authority reposed. The legitimate consequence of such management is a clashing of opinions and authority, whereby this main essential of proper construction is either compromised, hopelessly belittled, or lost sight of altogether.

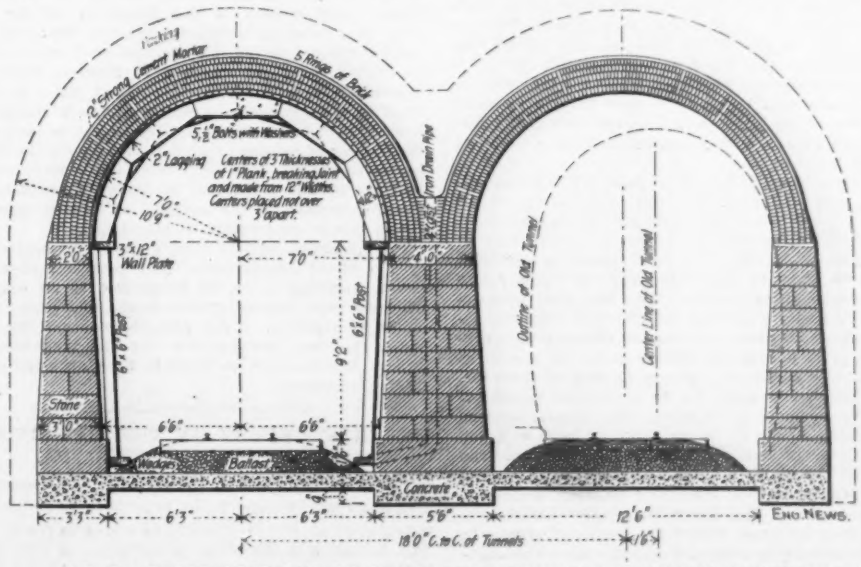


FIG. 5. CROSS SECTIONS OF COMPLETED TUNNELS SHOWING CENTERING USED TO TURN ARCH.

The present organization of your Board of Street Commissioners and the offices of City Engineer and Superintendent of Streets, and to combine the functions of all three into one single-headed commission. This plan proposes, therefore, the creation of a new city official to be designated the Commissioner of Public Works, who shall be appointed by the Mayor and approved by the Board of Aldermen, to whom he shall be answerable for his administration of municipal business. The said commissioner should be a graduate engineer of not less than ten years' practice, and of approved character and ability; he should be paid an adequate salary and should devote his entire time and attention to the business of his office. Maintenance and repair of streets, street openings, street sprinkling, street cleaning and street railway lines should be made subject to the control of the said commissioner, as well as all matters relating to the city streets of whatsoever nature. The functions of the offices of Superintendent of Streets and City Engineer should be continued subordinate to the said commissioner, who may also become the executive head of the water department, if that plan should subsequently prove acceptable to the public. With a department modeled on this or any similar plan in which the essential objects of its creation are faithfully conserved, there will be no difficulty in handling any amount of work which the city of Burlington desires to undertake. Once the efficient head of the department is established, the increase of the amount of work simply involves the increase of the force to handle it. The engineering and executive faculty is there to take care of it, whatever its proportions. It makes little difference, therefore, in this event whether the work be done by contract or not.

The claims of those who, as life dwellers in the city of Burlington, demand a share of employment on her municipal works, is one which should meet with a fair recognition, while at the same time it should not be permitted to conflict with public affairs, or influence its officials in the economical administration of their duties.

The system of maintenance of streets which I have to propose is simply an elaboration of that outlined in my first report. As therein stated, maintenance includes the proper offices of repair, cleaning and sprinkling of pavements. Economical maintenance necessarily presupposes that the roadbed has been correctly and scientifically constructed in the first instance, and therefore the remarks which follow assume that this has been done; but at the same time the application of the system is so flexible that its extension to streets not permanently constructed is quite possible, and, in fact, desirable. In my first report I made the following statement:

> The plan that appears to me the best adapted to the requirements of the city of Burlington is a limited "block" system, as an adjunct to a general system of repairs periodically made by an organized and well-equipped corps. The bulk of the repairs should be made by the general corps, the blockmen only attending to slight or "minute" repairs on the sections on which they are stationed. The character of the repairs should be in keeping with the original construction of the pavements. A practical and economical method should be pursued, and a record kept of the quantity of the materials, of the labor and cost thereof.

This statement outlines what might be regarded an ideal system, for the reason that by proper management the cheapest and most satisfactory results are thereby brought forth.

In the economy of municipal government the Department of Public Works ranks as a co-ordinate branch of the Police, Fire, and similar departments, each of these controlled by a single commissioner. My conception of the logical construction of a Department of Public Works would systematize the work by dividing it into the Street, Water and Sewer departments, each of which would be placed in charge of a superintend-

ent. The said commissioner being an engineer would embody and would furnish all the technical information necessary for the construction, maintenance and operation of the three departments. The management of the department of streets would obviously resolve itself into the construction and maintenance divisions, for each of which a separate account would have to be kept. Construction would mean the permanent building of roadbeds and all appurtenances thereto, maintenance, the perpetual care and repair of these after their completion.

If construction work were done by contract under public competition, as is usually the case, the work of the department would be limited to engineering, including inspection and maintenance. If, on the contrary, the permanent work is done directly by the department's employees, the Commissioner of Public Works would have to assume the dual functions of contractor and engineer, and would therefore need to have at his disposal a sufficient corps to carry on the work advantageously. The make-up of the constructive division of the department would be directly under his control.

The Superintendent of Streets would report daily to the department the status of constructive and maintenance divisions, and would receive orders issued by the commissioner as to the daily work to be done and the details thereof. The construction and maintenance corps would receive their orders directly from the Superintendent of Streets or through his assistants. Construction would be conducted by capable foremen responsible to the superintendent for the efficiency of the forces under their charge. Maintenance would be conducted in two ways: General repairs would be handled in the same manner as construction under the superintendent and his foremen; the "block" system would be directly under the supervision of a competent officer who might be designated General Inspector, having a thorough knowledge of the workings of the system. He would be responsible to the superintendent for the work of his corps, and would have to make daily reports of their doings.

The force of labor in the maintenance division would consist, therefore, of the "block men" and the "central" gang. The men who constitute the latter gang should be picked men, that is to say, they should all be able-bodied and sober, and those querulous and unruly spirits who make trouble for themselves and their fellow-workmen should be severely disciplined and summarily dealt with from the start. One of the problems that is constantly confronting the city authorities is the care and employment of a considerable number of workingmen who have, by reason of age or other infirmity, become incapacitated for hard labor, and have therefore become a city charge. The "block" system offers a splendid opportunity for the continuous employment of these men. It is light work and only demands steadiness and care. This feature tends constantly to develop the workman and to train him to his duties, so that if he is faithful he becomes in due time expert at his business, and reduces the General Inspector's functions to a formality and a report. Some sections where the traffic is heavy will require better men, but for the most part this system will permanently accommodate all the labor that would otherwise be expensively employed or be maintained as a public charge.

For the present, and so far as your city is concerned, this system may be said to be on trial of its merits. I have to recommend that every permanent street built be immediately classed on its completion as part of that system. As the network of streets is completed it will be found to advantage to divide the city into maintenance districts rather than into road sections. Thus the business part of the city will very conveniently divide into nine maintenance districts, each containing from one-half to three-quarters of a mile of streets. One blockman stationed in each of these districts would, and ought to, be capable of keeping it in first-class order, at all times. The asphalt sections will require hands to be stationed at least at every quarter mile to keep them in cleanly condition. The extent of the districts outside of the central sections will depend upon local conditions of traffic and wear, and can only be laid down after some experiment. In no case, however, should the length of streets in any one district be greater than one mile. Thoroughfares connecting with outside towns should be laid down in sections not over a mile long.

The removal of refuse and street sweeping will have to be economically performed by a system of patrol carts making daily rounds and depositing their contents at the nearest available dumping ground. The latter should be selected so as to remove the possibility of nuisance to the vicinity. On city streets there will be no great saving in storing stone for patching purposes at intervals, and the difficulty of securing storage places will make it impracticable. Such material as may be required from time to time had better be landed directly where wanted by the patrol carts. On out-of-town roads convenient places for stone and gravel may be found along the wayside, which should be selected for convenience at intervals. The street cleaning need not be detailed, but it will be found that the bulk of the work will consist in keeping the gutters clean and free from scourings. The special equipment of the blockmen will consist of a square shovel, a broad heavy rake, a pickaxe, a reed street broom, a wheelbarrow, an iron tamper with broad base and a sprinkling can. The chief duty of the blockmen will be to repair failures in the street surface as they appear, occasioned either by wear, storms or otherwise. The method of repairing should be to pick or "stock" the surface first, then to apply the material of the same kind as that composing the roadbed, to moisten it and tamp it down, finishing with a little binding material. The patch should be left slightly higher than the surrounding road surface. The daily reports of the General Inspector should cover the square yards of pavement patched, the amounts of materials used and cost thereof in each district. The general condition of each district should be detailed in a monthly report by the superintendent to the head of the department.

The maintenance work to be done by the central repair force is essentially construction, reconstruction, or general repair. The methods of general or periodic repair would have to be prescribed by the department and be conducted by the superintendent precisely in keeping with the specifications. The returns of the superintendent to the department should define exactly for what services or materials charges against the city are made, and the true nature, extent and value of the said services or materials should in each case be accurately recorded so as to render the cost of each operation in the work determinable. No complicated system of bookkeeping is required, but the entry of every item should so far describe its origin as to make businesslike deductions a possibility.

General repairs can ordinarily be deferred from three to six years, according to circumstances of traffic and local conditions. A good average condition is the only admissible one. The equipment of the central force will consist of a steam roller, preferably of 10 tons weight, a street sprinkler with broad tires, having a capacity of about 650 U. S. gallons, and the usual complement of implements. Chief among these are the square, short-handled shovels and the iron tampers for restoring pavements disturbed. The repair of the streets is essentially the same as that of laying the finished course on permanent work and need not to be dwelt upon.

There is no feature of the work of the Street Department which stands in such dire need of reform as that of replacing the materials of street openings. I have repeatedly emphasized its importance during the past season, and in the permanent work have insisted upon a radical departure from the method in vogue. Proper workmanship in this important matter can only be secured by laying down a cast iron rule requiring the use of the tampers, and that every 4 ins. back-filled should be rammed to firmness before a succeeding layer is added. The use of water in conjunction with rammers in sandy soils is a useful adjunct, but in heavy soils no water should be used and the number of rammers should always double the number of shovellers. The attitude of the department in this regard has been, and is likely to continue, a standing menace to the integrity of new pavements, unless this ruinous custom is abandoned.

The sprinkling of city streets should be controlled by the Street Department. The present system of street sprinkling seems to be subject to no control whatever, with the destructive results that might naturally be expected. A fair apportionment of the expense, therefore, between the city and the abutting owners would appear to me to be two-thirds and one-third, respectively.

EXPERTS' REPORT ON THE RESERVOIR FAILURE AT LANCASTER, PA.

The reservoir which failed recently at Lancaster, Pa., has been pronounced by experts to be so poorly constructed as not to warrant attempts to repair it. The failure was described in our issue of Oct. 25. Briefly, it appears that the substitution of brick for puddle about the blow-off pipe resulted in a leak, which soon caused a break in the bank sufficiently large to empty the reservoir of the 10,000,000 gallons of water which it then held, its full capacity being 15,000,000 gallons.

The reservoir was built for the city, and the city authorities requested Messrs. Howard Murphy, J. J. De Kinder and B. J. McGrann, as engineering experts, to report on the failure. The report of these experts, together with a report on the mechanical composition of the material used for the clay lining required by the specifications, is as follows:

Philadelphia, Nov. 24, 1894.

Hon. Edwin S. Smeltz, Mayor, Lancaster, Pa.

Dear Sir: Having been requested by you in writing "to inspect the broken reservoir to ascertain if it had been constructed according to the plans and specifications in every particular by the contractor" we respectfully report as follows:

We have paid two visits to Lancaster and made a thorough examination of the new structure which was intended to be a reservoir. We have given ample time for all parties interested to be heard, if they desired it, and herein fully comply with the instructions we received at a meeting of your special committee on water to make an entirely unbiased report.

We have been furnished with certain tracings and carbon copies of specifications. These plans and specifications are without signature or other evidence, within themselves, of authorship.

The tracings show in general a good and usual design for a reservoir except in the matter of the gate-house and pipe connection, the correctness of which we question. However, we have found nothing in the designs shown us which justify the failure of the structure. If the specifications had been adhered to it would not have failed. Its general dimensions have not been brought into question.

It is the clear intention of the specifications submitted that the reservoir should be lined with clay, protected by a coating of cement mortar and then a brick paving finished with grout.

The brick finish with its grout, although the blade of an ordinary penknife can be pushed to the hilt into any number of joints, might be acceptable under the specifications.

We have found material immediately under the bricks which we assume has been intended to represent cement mortar and which is no mortar at all, but merely an inferior quality of sand, discolored, presumably, with cement.

Under this is a material intended under the specifications to be clay, and which material, in fact, is not clay, but only at best a most inferior species of clay soil, overloaded with foreign matter, such as particles and lumps of rock, etc.

This material is entirely unfit for its intended purpose, which is to form the real retentive lining of the reservoir, the cement and brickwork being intended mainly as a protecting shield to the clay lining against washing and disintegration.

(Accompanying this report is a letter from Dr. Henry Leffmann, analytical chemist, Philadelphia.)

Again, the specifications require that "every layer will be well rolled with heavy grooved rollers, or rammed when rolling is impossible, until thoroughly compacted," while, in fact, the largest roller exhibited to us is not grooved, is made of a number (16) of cast iron sheaves, 24 ins. in diameter and 4-in. face, supported on a 2-in. axle, 6½ ft. in length. The weight of said roller, weighted and ready for work, was by calculation about 2,300 lbs., or slightly over 350 lbs. per running foot of axle.

It is impossible to designate this a heavy grooved roller and to consider that the specifications were complied with in using it.

Another clear evidence of the indifferent construction of the reservoir is given by the serious break which, according to information given us, occurred in the southwesterly corner when the reservoir was first filled to a height of nearly 15 ft., and in the many serious cracks which we observed in the various places.

Considering the various conditions noted, we report as follows:

That to repair the break with the purpose in view of utilizing the reservoir would be only inviting another disaster.

We are convinced that no portion of the structure is at all safe or can be relied upon, and the terrible consequences of a failure of the structure, on the city's side, are only too apparent.

We beg to add that it has only been after careful and minute investigations that we have arrived at the conclusion that the specifications have decidedly not been adhered to. Respectfully yours,

Howard Murphy, Civil and Hydraulic Engineer. J. J. De Kinder, Consulting Engineer.

Lancaster, Nov. 27, 1894.

Hon. E. S. Smeltz, Mayor, Lancaster, Pa.

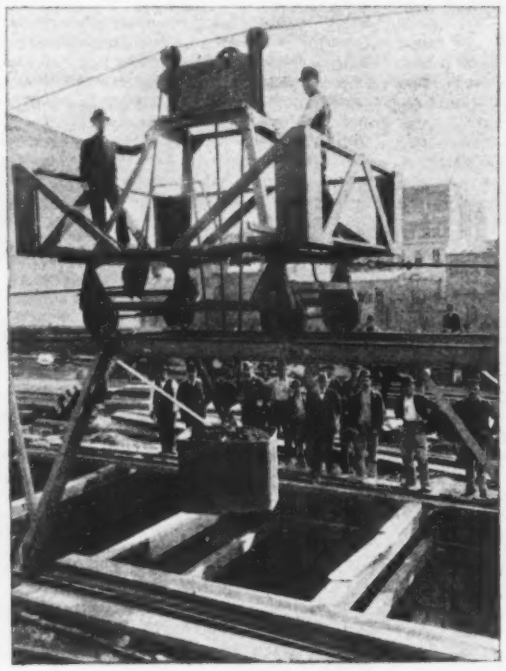
Dear Sir: I was not with the experts at all times during the examination of the reservoir, but, as to their interpretation of the specifications, I agree with them so far as I examined the work, and I concur with them in believing that the reservoir would always be a menace to the surrounding property.

Very respectfully, B. J. McGrann.

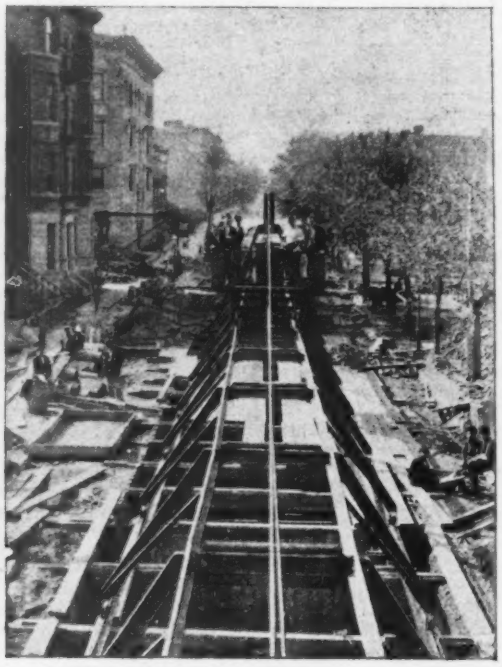
Mechanical Analyses of Clay Lining.

Howard Murphy, Esq., 326 Walnut St., Philadelphia.

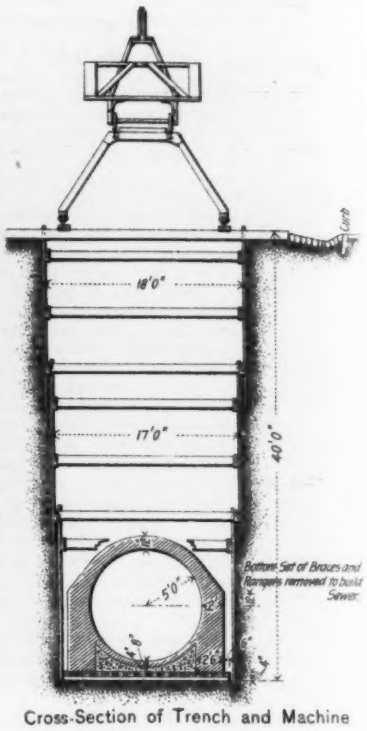
Dear Sir: The following is a result of a comparative



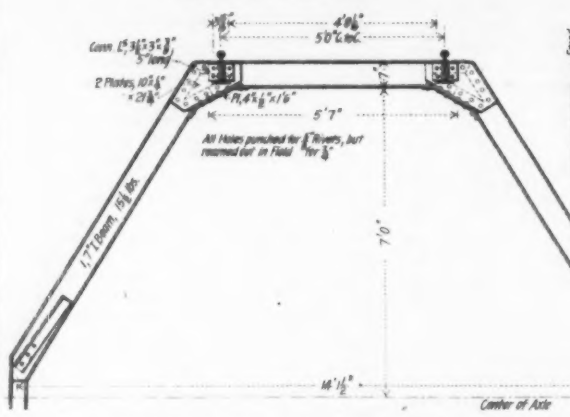
Traveling Car Hoisting a Full Bucket from the Trench.



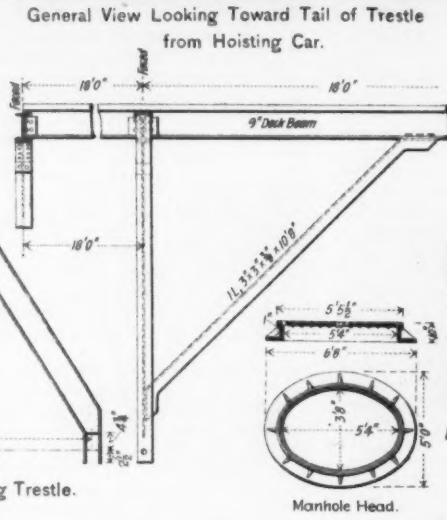
General View Looking Toward Tail of Trestle from Hoisting Car.



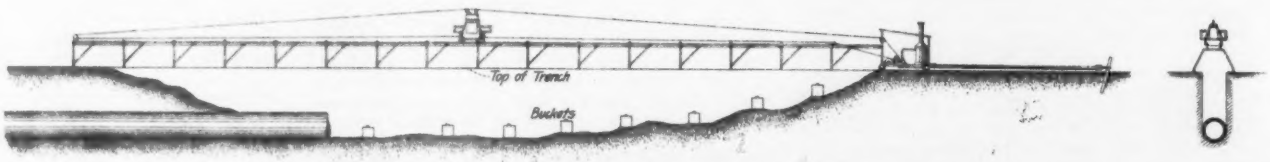
Cross-Section of Trench and Machine with Section of Completed Sewer.



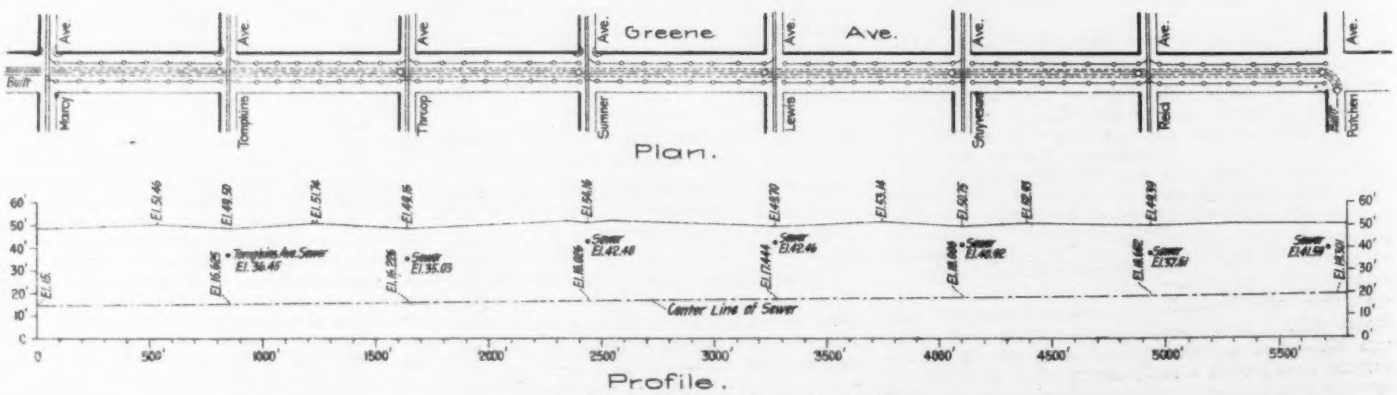
Side and End Elevations of Frame of Moore Traveling Trestle.



Details of Manholes, Greene Avenue Sewer.



Typical Longitudinal and Cross Section Showing Moore System of Excavation.



Plan and Profile of Greene Avenue Trunk Sewer.

The Moore Trench Excavating Machine,

As Used on the Greene Avenue Sewer Brooklyn, N. Y.

The Moore Manufacturing Co., Buffalo, N. Y., Builders.

CHAS. HAPT & SONS, LITH., 26 VESEY ST., N. Y.

mechanical analysis of the samples of clay from the Lancaster reservoir and of the standard clay submitted by you.

Equal weights of the air-dried clays were stirred in equal volumes of water and allowed to remain a number of hours until softened. Each mixture was then thoroughly shaken, allowed to stand quietly for half a minute, and then the watery portion poured off as closely as possible. The remaining sediment was dried. It represents the coarser particles, and the value of a clay will depend upon the proportion of coarse particles, the less the better.

The following weights were obtained:

No. 1. North side of break, 66% sediment.
No. 3. South side of break, 66% sediment.
No. 4. Standard, 37% sediment.

The above sediments were crushed gently with a spatula and with the fingers, so as to merely break up the lumps, and not reduce any grit to powder, and these were passed through a sieve, 40 meshes to the inch.

No. 1. Sediment allowed 43% to pass through.
No. 3. Sediment allowed 43% to pass through.
No. 4. Sediment allowed 80% to pass through.

That portion of the sediments of Nos. 1 and 3 which did not pass through the sieve contained numerous large lumps of slaty rock, while the small portion of No. 4 which did not go through was composed of small particles.

In regard to samples Nos. 1 and 3, taken respectively from the north and south sides of the break, I have to say that the material is evidently a very impure clay, not only by reason of the large proportion of iron, as shown in my previous report, but because there is in each sample a large proportion of unaltered rock, which interferes with the adhesive properties. A true clay, formed by the weathering of certain rocks, especially feldspathic rocks, will consist practically of aluminum, silicate and free silica. Such clays may be found in situ, or if transported by water to a new point, will retain their value if not mixed with other rocky material. The clay composing the reservoir samples is not only modified by the presence of a notable proportion of ferric oxide which diminishes its value, but in its formation or transportation (not having examined the original source of the clay, I cannot determine this point) has been mixed with slate pyrites, sand and other foreign matter in very coarse condition. It is, therefore, the fact of this large proportion of rocky material that makes these samples inferior in quality. By washing these samples thoroughly, and allowing finer material to settle in a separate vessel, a red clay of fair quality may be obtained, but still inferior to the standard. This red clay will constitute, as noted above, one-third the weight of the material as taken from the reservoir wall. I have submitted to you samples of the sediment from washing portions of the different specimens. Henry Leffmann.

THE MOORE TRENCH MACHINE ON THE GREEN AVE. SEWER, BROOKLYN, N. Y.

(With inset.)

In our issue of Jan. 2, 1892, we described and illustrated in considerable detail the construction of a large relief sewer in Brooklyn, N. Y., designed to carry the storm water and surface drainage from an area of about 1,300 acres and relieve a section of the city in which the sewers are taxed beyond their capacity during severe storms. The total length of this sewer is about two miles. It is 15 ft. in diameter at its mouth and 10 ft. in diameter at the head. The lowest section was built in open cut by Mr. Daniel J. Creem. The second section was built in tunnel by Messrs. Anderson & Barr, the method used being fully described in our issue above referred to. The upper section is now being built in open cut by the contracting firm of Jas. J. Moran & Co., and it is the work on this section which is illustrated on our inset sheet in this issue.

As seen by the profile, the sewer is at an average depth of about 40 ft. below the surface of tht street. The soil is a sandy loam, excavating easily, but requiring tight lagging and heavy bracing in the trench. The feature of principal interest in connection with the work is the use of the Moore trench machine by the contractors. The use of trench machines in sewer construction is now very general, as contractors have been quick to appreciate their advantage in saving labor. If their merits in avoiding the blocking of city streets and accelerating the progress of work were better understood by engineers and by city authorities, their use would be made obligatory for practically all street excavations to which they are in any way applicable.

The general method of operation of the Moore machine will be evident from the typical sections shown on our inset sheet. On each side of the trench is laid a line of light rails, footing on longitudinal stringers, and on the track thus formed stands a light steel trestle structure mounted on small castor wheels. At one end of this trestle is a double drum reversible hoisting engine and boiler, protected from the weather by by a light wooden house. Along the track which extends along the top of the framework runs a hoisting car, from which ropes lead to the winding drums of the engine at the head of the trestle.

In operation the buckets are scattered along the part of the trench where excavation is in progress, as shown in the typical profile. The hoisting car is brought over the point where a full bucket is ready, the hoisting rope is slacked and the empty bucket is lowered into the trench. When it reaches the bottom the hook of the fall block is transferred to the full bucket, the engineer hoists away, the bucket is brought into position on the car and securely locked and the traveling rope then quickly hauls the car toward the tail of the trestle until it reaches a point over the completed masonry. Here the load is dumped, and the car runs back with the empty bucket and is stopped over the place where another full bucket is ready to hoist.

It will be seen from the above general description that the method of operation is simple and is applicable in practically any kind of soil. Large boulders, buried logs, and any other obstruction encountered can be hoisted by simply putting a rope sling around them and hooking on the fall block, and when hoisted can be carried back and dropped into the trench over the completed masonry, or can be deposited on a truck for carting away. The apparatus can also be utilized to lower material into deep trenches. In fact, it is practically a traveling crane, commanding the whole length of trench on which work is in progress, and applicable to all work of hoisting and conveying, as well as to its primary purpose of transferring excavated earth from the head of the trench to a position over the completed portion of the sewer.

Describing now in detail the machine at work on the Green Ave. sewer, the trench now being excavated is 18 ft. wide and about 40 ft. in depth. The gage of the wheels which support the trestle frame of the machine is 14 ft. In this case, therefore, the rails are laid on longitudinal stringers resting on cross-ties running across to the top of the trench. For trenches 13 ft. or narrower these cross-ties are not required, the stringers being laid on the ground beside the trench. The trestle is made up of 16 interchangeable sections or bents, supporting a line of girder rails, and each section braced by steel angles to give it longitudinal stability. The separate sections are bolted to each other by turned steel bolts to form one rigid structure. The wheels which support these sections are double flanged and turn on steel pins for axles. The rails used are very light, to facilitate easy handling, but are quite sufficient for their work, as their rolling load is only the light weight of the trestle framework. The girder rails at the top of the trestle on which the hoisting car travels, however, are of heavy pattern, as they carry the rapidly-moving hoisting car and also form the longitudinal members of the trestle framework.

The hoisting car consists of a steel frame, mounted on four chilled wheels and surrounded by a wooden platform, on which the operators stand. The photograph on the inset sheet shows the car hoisting a full bucket from the trench. A very important detail of the machine is the apparatus which supports the bucket while the car is in motion, as the accidental dropping of a bucket while being transported might cause a fatal accident. As seen by the engraving, the fall block has a hook-shaped top, so made that as the bucket is hoisted this hook automatically engages with a supporting pin on the gallows frame of the car. The bucket is then supported entirely by this pin and the hoisting rope is under no tension while the car makes its journey to the end of the trestle and back.

The bucket (of which there are ten in use on this work) is a plain sheet iron tub with a hinged bottom, which is locked on the inside and cannot be unlocked except by a special wrench, carried by one of the attendants on the car. With this inside lock the bucket may be swung against braces or timbers without danger of releasing the lock and dumping the load on the heads of the men below. Each bucket holds 30⅓ cu. ft. of earth. In operation one man in the trench attends to hooking on the full buckets. He is given a red hat or some other peculiar costume which makes it easy for the engineer to distinguish him, and as soon as one full bucket is hoisted he goes to the place where the next one will be ready when the hoisting car returns. The engineer, watching him, knows where to stop the car on its return. Of the two men on the hoisting car, one releases the bottom of the bucket to dump its load, the other works a lever which lifts the bottom back into place, and also operates a brake to hold the hoist car in place when working on an incline. The first man also unlocks the empty bucket from the supporting pin when it is to be lowered into the trench.

A feature deserving especial commendation is the position of the engineer. He is given a comfortable seat behind his engine, and looking out over it along the line of the trench he can see clearly every motion which he controls. Throttle and reverse levers and hand or foot levers controlling the hand brakes and friction clutches on the drums are placed within easy reach. The engine used has two 7 × 10-in. cylinders and double drums 18 and 27 ins. diameter. The boiler is of the vertical tubular type, 4 ft. in diameter and 8 ft. in height. The entire equipment was built by the Moore Mfg. Co., at its works in Buffalo, N. Y. Several details of the engine and of the excavating machine are the invention of Mr. Thos. F. Moore, president of the company, and are covered by patents.

An important feature of the machine is the ease with which it is moved along the trench as the work proceeds. The power house is on wheels, as well as the trestle, and, in fact, forms one structure with it. To move ahead it is only necessary to loosen the clamps by which the power house is anchored in place, lead a rope through a snatch-block attached to a dead man or other suitable support some distance ahead, and by winding the rope on the hoisting drum the whole structure is moved steadily ahead. The rails at the rear are, of course, brought forward to the head as the movement goes on. In this way the movement of the machine as the work advances is effected with very little expense or delay to the work.

The capacity claimed for the machine by its builder is 800 cu. yds. per day. It will be evident from the above description that this capacity could be considerably increased if desired by the use of larger buckets. In any ordinary sewer trench, however, the machine can handle as large a quantity of earth as the force of shovelers which can work in the trench can excavate; and this rate of progress, moreover, is about as rapid as the masons building the sewer can keep up with.

Trench machines built by the Moore Mfg. Co. similar to that now working on the Green Ave. sewer have been at work during the present season in Buffalo, Niagara Falls, Binghamton, Rochester and Brooklyn, N. Y.; Indianapolis, Ind.; Aurora, Ill.; South Bend, Ind.; New Orleans and Philadelphia.

THE MAXIMUM PRACTICABLE LENGTH FOR SUSPENSION BRIDGES.

(Concluded from p. 446.)

Towers.

The weight of the towers forms no part of the suspended load, and therefore is only indirectly connected with the question of the maximum span. There is, of course, a practical limit to the height to which the towers can be carried, and the relation between their cost per vertical linear foot and the cost of the suspension system per linear foot of span will be an important element in determining the most economical versaine for the cables.

The towers will be supposed to be formed of steel columns braced together, and will start from the upper surface of the masonry, 165 ft. below the lowest point of the cables. An empirical formula, giving the approximate weight of metal (W_t) in the towers, has been deduced by Mr. Lindenthal from various estimates of designs for suspension bridges, as follows:

Since the section of the cable is throughout the same, the tangent to the cable at the tower in the end span should intersect a horizontal line tangent to the cable curve at a distance from the axis of the

tower not greater than that of the intersection of the similar tangent in the middle span; hence the end spans should each be at least one-fourth of the main span, and the entire length of the bridge from face to face of anchorage should be at least 1.5 L. Subject to this condition, the end spans should be made as short as convenient to save cable weight. This is also important, when the backstays carry any directly suspended load, because the bending moments from the live load in their stiffening girders may otherwise become greater than in the main span. In the present investigation, however, the loads in the side spans are supposed to be supported from beneath, and the backstays have simply to transmit the suspended load of the main span to the anchorages, the pressure on the top of each tower being equal to the total dead and live load of the main span.

Let L_n = length of the bridge exposed to wind pressure reacting laterally on the towers, in this case equal to L.

h_t = height of the metallic portion of the towers from bedplate to cable bearing.

W_s = suspended dead load plus maximum live load per unit of span.

R_t = reaction at top of towers, = 2 L W_s (for both towers).

w_1 = weight of steel per lin. ft. of 1 sq. in. cross section = 3.4 lbs.

S = factor of safety. This will be assumed as 3.

u = ultimate strength of steel per square inch, corresponding to S = 1.

a = coefficient of practice, including stairways, housings, cable bearings, etc., deduced from actual designs = 1.65 (Lindenthal).

Steel having an ultimate strength of from 90,000 to 100,000 lbs. per sq. in., and an elastic limit from 56,000 to 60,000 lbs., is considered by Mr. Lindenthal more suitable and economical for heavy towers than a forgeable or punchable steel, with an ultimate strength of 60,000 lbs. All rivet holes in such high steel must be drilled and not punched and reamed.

The metal in the towers is proportional to the reaction R_t and the height h_t. The weight of metal in the towers, exclusive of bracing, will therefore be

$$\frac{R_t\ h_t\ s\ a\ w_1}{u}.$$

The towers require bracing against wind pressure and bending from temperature changes in the cables. The metal in the braces will be proportional to the square of the height of the towers and to the length L exposed to wind pressure and temperature changes; hence the weight of the bracing in tons will be L h_t^2 S b, in which b is the coefficient of proportional weight deduced from actual designs = 0.001 (Lindenthal).

The weight of the towers will therefore be

$$W_t = \frac{R_t\ h_t\ s\ a\ w_1}{u} + L\ h_t^2\ s\ b = h_t\ S\ \frac{(R_t\ a\ w_1 + L\ h_t\ b)}{u}$$

Making s = 3, w_1 = 3.4, a = 1.65, b = 0.001, R_t = 2 W_s L, and u = 60,000, we obtain for the weight of the towers in pounds

$$W_t = \frac{L\ h_t}{333}\ (0.187\ W_s + h_t)$$

This is on the assumption that the towers are constructed on the plan followed by the New York Board, so that the cables may be arranged side by side, and that steel of an ultimate strength of 60,000 lbs. per sq. in. is employed in their construction.

Backstays.

The length and consequently the weight of the backstays will depend entirely upon the arrangement of the end spans, and this will in every case be determined by the local conditions. If l represents the length of a single backstay, the total weight (W_b) of the backstays for the whole bridge will be W_b = 2 l w', in which w' = the weight of all the cables per linear foot.

If the backstays intersect the horizontal plane, tangent to the cable-curve at a distance ¼ L from the axis of the towers (which is the most economical arrangement so far as the total amount of cable metal is concerned), the length of each stay from the floor level to the top of the tower (the floor being considered horizontal and 60 ft. below the lowest points of the cables) will be $5\left(\frac{L}{8} + 60\right)$ to which should be added a constant length of about 100 ft. to carry the end of the stay to its point of connection with the anchor chain, which should be well below the floor level. For this case the formula becomes:

$$W_b = (468.3 + 0.559\ L)\ w' = (440.6 + 0.537\ L)\ w.$$

Anchor Chains and Plates.

The anchor chains are formed of steel eyebars and connect with the cables outside of the masonry of the anchorages, and with bearing plates of rolled steel at their lower ends. They are proportioned for a stress of 20,000 lbs. per sq. in., with an allowance of 40% for the weight of pins and constructive details. The tension on each backstay is 18,960,000 lbs. The weight of the anchor chains per linear foot for each backstay will therefore be:

$$\frac{18{,}960{,}000 \times 3.4 \times 1.4}{20{,}000} = 4{,}512 \text{ lbs.}$$

The length of each chain may be assumed as 200 ft. The weight of chains for each backstay will therefore be 902,400 lbs. The weight of steel in each anchorage plate may be assumed as 100,000 lbs., making the total weight of anchorage metal for each backstay 1,002,400 lbs. If n represents the number of standard cables in the bridge, the total weight of the anchorage metal (W_a) will be W_a = 2,004,800 n.

In this formula no deduction of weight is made for the diminution of the tension due to the friction of the chains on their supports.

For the bridge of maximum span with 16 standard cables we have W_a = 32,076,800 lbs. =16,038.4 tons.

Masonry and Foundations.

Anchorages.—As the anchorage masonry acts merely as a weight, an inexpensive class of masonry can be used everywhere except, perhaps, in the immediate vicinity of the bearings of anchorage cables and plates. The foundations need go no deeper than necessary to obtain a soil giving sufficient resistance to horizontal sliding, and therefore will be of comparatively simple and easy construction.

Tower Foundations.—The lower portion of the towers above ground and all that below ground will naturally be built of masonry, and may be all treated as constituting the tower foundations. Being proportioned directly to the weight which they have to carry, such foundations for suspension bridges differ from those of other bridges only so far as affected by the great height of the towers proper and their consequent great weight and leverage; and therefore are like other foundations, except that they must be given more cross-section, more care and a better footing upon their beds.

In proportioning such piers, the New York Board adopted the following limits of stress: The pressure between the metallic bed-plates and the top of the masonry should not exceed 20 tons to the square foot. The pressure within the masonry and on the foundation should not exceed 10 tons to the square foot; but in determining these pressures, the weight of materials displaced by the pier is to be deducted. The New York Board remark that "while these pressures have been exceeded in some structures, they are higher than in usual practice, and call for masonry of good quality and of more than ordinary cost."

The method of foundation construction will depend greatly upon local considerations. For a bridge of maximum span these foundations should rest upon solid rock, if possible, and at least upon hard, incompressible impermeable soil. Modern methods have already established foundations at a level of 162 ft. below the water surface, and provide means for going still deeper, if necessary, and for obtaining a properly leveled surface in the rock when found; so that the question of foundations affects to-day only the economy and not the engineering practicability of bridge construction.

The Engineering Problem of Maximum Span.

It is now proposed to investigate the maximum length of span practicable for a suspension bridge entirely from an engineering point of view, leaving the question of the relation between traffic capacity and cost of construction for subsequent consideration.

If we suppose the cable-curve to be referred to rectangular axes through the lowest point as an origin, we have from the construction of the funicular polygon:

$$\frac{dy}{dx} = \frac{1}{Q}\int P\,dx.$$

in which Q represents the constant horizontal tension at any point of the polygon, and P the total suspended load per linear foot of span. The units are the pound and the foot.

The load, P, is composed of the weights per unit of span of the live load, track platform, bracing, cables and suspenders, some of which vary slightly with x; but the Board has found by a careful analysis that even with the unusual weights and spans considered in this investigation, the error involved in the assumption that P is constant is too small to be of any practical consequence. It is therefore assumed that the load is uniformly distributed, in which case we obtain by integration for the equation of the cable-curve, $y = \frac{p\,x^2}{2\,Q}$, which represents a parabola. If L represents the span and R the ratio of the span to the versine of the cable, we obtain, $Q = \frac{P\,L\,R}{8}$.

The greatest stress on the cables is at their highest points, and for this maximum tension the strength of the cables must be proportioned. Its horizontal component is the constant horizontal tension Q and its vertical component is the weight on the half span, $\frac{P\ L}{2}$.

If T represents this maximum stress we obtain

$$T = \sqrt{\frac{P^2\,L^2}{4} + Q^2} = \frac{P\,L}{8}\sqrt{R^2 + 16} \overset{(P' = w)}{=} \frac{}{8}\,L\sqrt{R^2 +}$$

If we represent by L_1 the limiting span, that is, the span at which the cable will carry its own weight with a given stress per unit of cross-section without carrying any other load whatever, we obtain from the above equation, by making p' = O and L = L_1

$$T = \frac{w\ L_1}{8}\sqrt{R^2 + 16}$$

hence

$$\frac{p' + w}{w} = \frac{L_1}{L}.$$

From the above equations we obtain

$$L_1 = \frac{8\ T}{w\sqrt{R^2 + 16}}$$

For metallic towers and large spans the value R = 8 will be generally about the most economical value for the ratio of the span to the cable-versine, when the cost of the foundations is taken into consideration. If we make R = 8 and substitute for T the working strength per square inch of the material of the cable, which we have assumed as 60,000 lbs., and for w the weight of a linear foot of the cable measured horizontally, and having a cross-section of 1 sq. in., which is 3.54 lbs., we obtain L_1 = 15,160 ft.; and

$$\frac{p' + w}{w} = \frac{15{,}160}{L}$$

The values of p' and w in pounds, as determined previously, are as follows:

$p' = 13{,}605 + 27{,}764{,}726\ L^{-1} + 3.24906\ L + 0.00055335\ L^2 + 0.000000003\ L^3$.

w = 17,917.

Substituting these values and reducing we obtain $31{,}522\ L + 3.24906\ L^2 + 0.00055335\ L^3 + 0.000000003\ L^4 = 243{,}856{,}994$, the solution of which gives for the practical maximum span L = 4,335 ft.

This span is measured between the highest points of the cables at opposite ends of the bridge. The Board consider this a conservative value of the maximum span, as it is based upon assumptions well within the limits of theory and experience.

The elements of the bridge, deducted by the preceding formulas, are as follows:

Span between tops of cables.....feet	4,335
Height of towers above masonry..... "	707
Number of cables.....	16
Diameter of each cable with wrapping.....inches	21½

Suspended weight per linear foot of span.

	Pounds.
Live load	6,353
Platform	7,200
Stiffening girders	25,202
Wind bracing	4,106
Cables	17,917
Cable wrappings	433
Suspenders	1,445
Total suspended weight per linear foot.....	62,656
= 31.328 tons.	

	Tons.
Suspended weight for whole middle span =....	135,807
Weight of backstays.....	24,882
Weight of anchor chains and plates.....	16,038
Weight of towers.....	57,172
Total weight of metal in the bridge.....	233,899

The Relations Between Span, Traffic and Cost.

In the preceding pages the Board have determined to the best of their ability the maximum span practicable for a suspension bridge from a purely engineering point of view. Their instructions further require them to investigate the maximum span "consistent with an amount of traffic probably sufficient to warrant the expense of construction." This involves the consideration of two subjects; the cost of construction and the traffic capacity of the bridge.

The cost of a suspension bridge cannot be determined simply as a function of the span and traffic. In the construction of every such bridge there are elements of cost which depend almost entirely upon local conditions, and cannot be estimated even with the roughest approximation until these conditions are fully known. For example, the cost of the piers will depend upon the depth of the solid foundation below the bottom of the stream or the surface of the ground; the cost of the towers and anchorages will depend upon the height at which it is necessary to elevate the roadway above the water surface, which again will depend upon the character of the river navigation; the cost of spaces for anchorages, approaches and terminal facilities will depend upon the local land values.

By examining the detailed costs of several very large

bridges, it is found that these indeterminate local elements constitute on the average more than 60 per cent. of the cost of such bridges in cities. It has been stated that in the case of the New York & Brooklyn Bridge, the cost of the bridge structure proper was only one-third of the expenditure for the entire work. In the case of the suspension bridge to cross the Hudson at New York, estimated for by the New York Board, the local elements determine about 54 per cent. of the whole estimated cost, although the cost of approaches, terminal facilities and land are not included.

The determination of any relation between traffic capacity and the cost of construction warranted thereby is equally difficult. It may, of course, be assumed that the bridge of maximum span will be constructed only in a locality where the conditions of commerce justify the belief that the traffic capacity of the bridge will be fully utilized. But in the general case it is impossible to determine what charges the traffic will bear. Moreover, the construction of such a bridge might be desirable even if the traffic were not likely to give a sufficient return for the vast sum invested. By the combined action of railroad companies, such a bridge might be built for the general benefits resulting from increase and facility of traffic, even though it might fail to earn directly a reasonable interest on its cost; and the enterprise might be assisted by adjacent cities, as was done in the case of the New York and Brooklyn Bridge.

But while the Board have been unable to arrive at definite conclusions in the general case, they believe that much may be learned from the study of the problem as limited by the conditions of a special locality, and the material for such inquiry is furnished by recent investigations in connection with proposed bridges across the Hudson River at New York.

It is said that the number of ferry passengers crossing from New Jersey to New York city now exceeds 85,000,000 per year, and the passenger and freight traffics are growing rapidly. It can scarcely be doubted that a bridge in this locality would be used to its full capacity. Such a bridge would, however, be employed principally for passenger traffic, the facilities for moving freight on floats at water level to any point on the water fronts being ample and convenient.

The Hudson River at New York forms the most important part of the interior harbor. Its mid-channel depth of at least 49 ft., and its clear width of at least 2,800 ft. between pier-head lines, make it one of the finest roadsteads in the world. It is navigated by an enormous commerce. Strong protests against its obstruction by a pier in the channel have been made by the commercial interests of the port. The least objectionable location for such an obstruction would be not far from the middle point, between the pier-head lines, where it would divide the upstream and downstream traffic, but this location is prohibited by the great depth to a firm foundation.

The New York Board reported that it is safe and practicable to cross the river with a single span, and estimated the cost of a suspension bridge for that purpose, its New York pier being between 59th and 60th Sts., at $30,743,000. This is the estimate for their lighter structure, but it provides for a bridge amply sufficient for the purposes for which it is intended. Moreover, the estimate was made for the purposes of comparison, and the report of the Board distinctly states that it is not to be taken as an absolute estimate of cost. This Board considers this estimate perfectly satisfactory for the purpose for which it was made, but they think it desirable to determine a minimum as well as a maximum estimate, to show the variations to which such estimates are liable and how much they are affected by legitimate differences in the assumptions upon which they are based. An estimate has therefore been made on the following assumptions:

The cost of structural steel is taken at 4 cts. per lb., in accordance with the views of a majority of the New York Board, as indicated in their report.

The cost of wire is taken at 7 cts. per lb., which is based upon prices given by leading manufacturers and upon actual experience in the case of the New York and Brooklyn Bridge.

The weights of metal are determined by the formulas given in this report.

The bridge is supposed to be located near 69th St., New York, and the cost of the substructure is assumed to be the cost at the lower location (between 59th and 60th St.), as estimated by the New York Board, less $2,900,000, which they state would be saved by adopting the upper location. The minimum estimate is as follows:

Structural steel:		
Suspended weights	lbs.	90,870,000
Towers	"	52,313,000
Chains and anchor plates	"	18,324,000
Total	"	161,507,000
At 4 cts. per lb.		$6,460,280
Wire work:		
Main cables and wrapping	lbs.	30,358,000
Backstays and wrapping	"	22,738,000
Suspenders	"	3,222,000
Total	"	56,318,000
At 7 cts. per lb.		$3,942,260
Cost of superstructure		$10,402,540
Cost of substructure		11,784,000
Total cost of bridge		$22,186,540

The final plans for a work of such magnitude would only be adopted after the most extended theoretical and experimental investigations, and the estimated cost would undoubtedly be much reduced by such studies. Assuming the most favorable location and the most competent engineering management, the Board believe that $23,000,000 is a reasonable estimate for a six-track railroad suspension bridge 3,200 ft. long, and they consider the amount of traffic which such a bridge would accommodate sufficient to warrant the expense of construction. They believe, however, that the bridge should be so constructed that its capacity can be readily increased, and with the suspension system this can be provided for by giving suitable dimensions to the towers and anchorages.

If sufficient inducements were offered to competent engineers to prepare competitive designs and estimates for a single-span bridge at this locality, the Board do not doubt that perfectly satisfactory plans would be obtained within the limit of cost of the estimate given above.

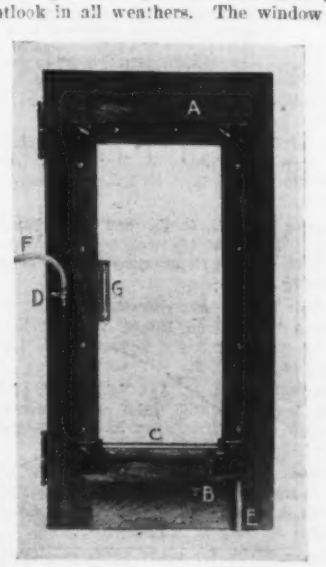
The Board desire to express their obligations to Mr. Gustav Lindenthal, C. E., Mr. W. Hildenbrand, C. E., and Mr. L. L. Buck, C. E., for information and valuable suggestions.

The following appendices accompany this report (not reprinted.—Ed.): A—Orders and instructions. B—Correspondence with wire manufacturers. C—Wind pressure. D—Temperature Strains in Three Hinged Arches, by Gustav Lindenthal, C. E. E—The Theory of the Stiffening Girder, Prof. J. Melan.

C. W. Raymond, Major, Corps of Engineers; Wm. H. Bixby, Captain, Corps of Engineers; Edw. Burr, Captain, Corps of Engineers.

THE TINKER STORM WINDOW.

The obscuring of the windows of locomotive cabs, pilot houses, etc., by snow or frost is a frequent source of inconvenience and of danger in winter weather. We illustrate herewith a storm window designed to prevent this and give a clear outlook in all weathers. The window shown



The Tinker Storm Window.

is intended for a locomotive cab, but similar windows are made for pilot houses, lighthouses, etc. The window consists essentially of two panes of glass about ⅝-in. apart with heated liquid between them. In the accompanying cut A is a cup by which the window is filled; B a cock by which the window is drained; C is a tube through which steam is passed, this heated tube imparting the warmth to the liquid; D is a cock for regulating the supply of steam; E, a rubber tube carrying the exhaust steam below the running board of cab; F, the steam connection from boiler, and G, a thermometer between the glasses for determining the heat of the fluid. The steam does not come in contact with the water, but merely heats the tubing, which in turn imparts the heat to the water. The amount of steam is regulated by the cock D, only a very small jet being required to warm the water, the usual temperature for which is from 100 to 120°. The first window was applied to the cab of an engine on the Concord & Montreal R. R. in November, 1892, and gave very satisfactory results, being clear of snow or steam when the other windows were obscured by snow on the outside or steam on the inside. It has also been used on the Boston & Maine R. R., and the enginemen like it because they do not have to open the window in order to look ahead, as they often have to do with the ordinary windows in severe weather. The device is the invention of Mr. H. W. Tinker, and is manufactured by the Tinker Storm Window Co., of Springfield, Mass.

FAILURE OF A BUILDING AT MONTREAL, CANADA.

As reported in our issue of Nov. 15, a building erected for the Montreal Street Ry. Co. collapsed on Nov. 9, and two workmen were killed. An extended investigation of the causes of the accident has been conducted before a coroner's jury, a large number of witnesses being called on to testify. The building was a five-story structure, and was practically completed at the time of the accident. The investigation has produced a voluminous mass of testimony, most of it, however, bearing on local circumstances and conditions and these not of general technical interest. The best statement of the circumstances of the accident which we have thus far seen was made by Mr. Geo. F. Hammond, of Cleveland, O., who was employed by the Street Railway Co. to prepare a report upon the accident. The following is a condensation of Mr. Hammond's report:

My examination has been particularly confined to determining the cause of the recent collapse at the north end of the building at the Craig St. point. I have based this report upon the examination of the building as I find it.

I have made estimates of the strength of the steel girders and beams used in the construction of the portion which collapsed. I find that the construction of this portion consisted of 15-in. girders, spaced about 10 ft. c. to c., and connected with cast iron columns at the fifth floors and roof, and resting in brick longitudinal partition walls at the first, second, third and fourth floors.

These walls as built extended at right angles from the Craig St. front of the building back to a transverse partition wall; these longitudinal walls were pierced with openings in several places. The thickness of these walls is 16 ins. on the ground floor story, first story and second story, and 12 ins. in the third story, on the top of which 12-in. walls the superstructure was supported by cast iron columns resting on the 12-in. walls. The 15-in. girders at the fourth floor rested on the wall just below the columns in the fourth story, but were not connected to them. Between the girders fastened to these columns 7¼-in. "I" beams were bolted, with their lower flanges resting on the top of the lower flanges of the 15-in. girders.

Mr. Hammond then explains detailed calculations which show that the girders and the columns had a large surplus of strength, and continues:

The load supported by the northeast column in the fourth story was directly transmitted to the top of the 12-in. wall by means of a cast iron plate on which the column rested. This plate had a bearing surface on the brick wall 12 ins. × 17¾ ins., or an area of about 1½ sq. ft. Therefore, estimating the strength of the floors at 150 lbs. per sq. ft. safe load, and the roof at, say, 100 lbs. per sq. ft., the load transmitted to the brick work by the plate under the column would be in accordance with the following table:

Wood roofing, 20¾ × 10¾ = 223 sq. ft. at 8 lbs.	1,784
Roof, including superimposed load of snow and ice, 20¾ × 10¾ = 233 sq. ft. at 100 lbs.	22,300
Column in fifth story	1,250
Fifth floor, 20¾ × 10¾ = 253 sq. ft. at 150 lbs.	33,450
Column in fourth story	1,385
Total	60,169

This load, when distributed over an area of, say, 1½ sq. ft. of 12-in. wall formed at this point, of brick laid in cement mortar for a few courses, would be equal to 40,113 lbs. per sq. ft., or 278 lbs. per sq. in., or over 20 tons per square foot.

Immediately below the column in the fourth story the load from the girders supporting the fourth floor was concentrated, the area being the same as the fifth floor, viz., 223 sq. ft. Estimating the load at

150 lbs. per sq. ft., there would be concentrated on the wall, which was here built of lime and mortar, 33,450 lbs. more, thus making a total load concentrated at this point of 93,619 lbs. This load, when distributed over an area of, say, 1½ sq. ft. of 12-in. wall, formed at this point of brick laid in lime mortar, would be equal to 62,413 lbs. per sq. ft., or 433 lbs. per. sq. in., or over 31 tons per square foot.

Having shown what strains would be imposed were the building loaded to its limit, Mr. Hammond proceeds to compute what load was actually sustained at the time of the accident. He weighed samples of the tiling from which he computed the weight of the roof, and found that at the point where the loading was heaviest the pressure was 30,112 lbs. per sq. ft., or 209 lbs. per sq. in. He therefore concluded:

I am of the opinion that there can be no question but that the cause of the collapse of the upper portion of the building was the failure of the 12-in. brick wall in the third story. These walls were serried by openings in several places, the east wall in particular having a door and a window opening, separated by a brick pier of the height of the window, over which the load from the second column from Craig St. and the girders under it concentrated their loads. This small pier, if constructed in accordance with the plans, was 12 ins. thick and by 3 ft. 3 ins. long, and contained an area of 3¼ sq. ft. I am of the opinion that this pier was the particular portion of the brick wall which failed.

EXPLOSION OF A CAST IRON STEAM HEATING BOILER.

On Nov. 22 a steam heating boiler in the basement of a public school building at Uxbridge, Mass., exploded, wrecking the floor above it, and endangering the lives of over 200 children who were in the building at the time. The accident has been investigated by Mr. Thos. Hawley, the assistant to the chief of the Metropolitan District Police, in charge of the inspection of boilers. (Eng. News, Feb. 8, 1894.) Mr. Hawley's report is as follows:

The exploded boiler had been in use about 15 years. It was of cast iron, nearly square in shape, with an internal firebox extending the length of the boiler to the rear water leg. The grate was not as wide as the firebox, the heated gases passing over each side of the grate under the bottom of the water leg and along the external shell to the flue.

The boiler was composed of two independent sections over and surrounding three sides of a single grate, the sections being connected only by circulating pipes. The first section was 20 × 40 ins., and the second section was 28 × 40 ins. The top of the firebox was slightly crowning, and was provided with a fusible plug, and the top of the external shell of each section was slightly crowning. A cover was bolted on the center of the top of each section, and from these covers steam risers were taken.

The second and larger section gave way, blowing the top of this section completely off, one piece weighing over 100 lbs. The line of fracture was from 2 to 4 ins. from the sides of the boiler. The boiler plate varied in thickness from ½ in. to a scant ¼ in.

An examination of the fracture shows that it started from two cracks, one about 4 ins. long at the rear, on the right hand side facing the boiler, and a smaller crack at the front right-hand corner. These cracks were evidently caused by the bulging of the top by the pressure beneath it, causing the plate to rise and fall with every change in pressure, finally cracking at the bending point. The crack had been bleeding and evidences of the leak were on the external shell and I do not believe were of very long standing.

The front plate gave way at the larger crack, this being clearly shown by the position in which the broken piece was found and also from the position of the steam riser pulled from this section by the explosion.

From the statements of the janitor it appears that he left the school at 8:45 o'clock, having another school to attend to. He left 4 lbs. pressure upon the boiler, a heavy hard coal fire, with the furnace door closed and the automatic damper open, which was expected to close the draft door with an increase in pressure. The boiler supplied steam coils in six rooms, four of which were occupied.

The day was warm and all the coils but one were shut, hence there was almost no demand for steam, and a heavy fire on the grate, which, with the fire-door closed, would continue to burn freely for a long time, after the draft door was closed.

The safety valve was 1¼ ins. on a ¾-in. pipe, making practically a ¾-in. safety valve and this was totally inadequate to discharge the steam as fast as produced, without an increase of pressure. That this was the case was also shown by an experience of the janitor last winter, when he returned to the boiler and found the safety valve blowing freely, set at 7 lbs., yet the pressure on the boiler was 20 lbs., to which it had risen despite blowing off.

All the conditions were present to bring about a heavy pressure on the boiler. A heavy fire, no use for the steam made, a safety valve totally inadequate to relieve the boiler, leave no other conclusion than that the pressure reached a point unusually high with this boiler, and in the cracked condition of the plate, the explosion was the natural result.

Even with the crack and the high pressure at which this boiler exploded, it might still have held had not the boiler had been naturally weak. The boiler itself, under any condition, is faulty in design and an unsafe one to use. The large section was almost flat on top, 20 × 40 ins., in places less than ¼ in. thick, of cast iron, and this large surface was not stayed in any adequate manner.

Deducting a ring 4 ins. wide, as supported by the vertical sides, it leaves an unsupported, practically flat, plate with an area of 800 sq. ins., which, with 10 lbs. pressure on the boiler, would bring a load of 8,000 lbs. on this unsupported plate. With 20 lbs. pressure, at which the janitor has found it, the load would be 16,000 lbs., or eight tons.

If a man should set up a plate of thin cast iron, supported only on the sides, 20 × 40 ins., and expect it to support a movable load of eight tons, the foolhardiness of the attempt would be instantly condemned by every observer; yet that is exactly what was done with that schoolhouse boiler, how often no one knows, but very frequently known to be very near that load. Not only is the strain dangerously excessive, but it acts to crack the boiler exactly as it could have been predicted it would.

In setting the boiler it was not furnished with check valves to prevent the loss of water by a failure to close the radiator return valves. This, however, has nothing to do with the explosion, but is dangerous, and is liable to produce low water, and is a common condition in schoolhouses. The fusible plugs, found melted, show it to be in working condition, but they did not melt until after the explosion, which indicates that there was plenty of water in the boiler when the explosion occurred.

To summarize: The direct cause of the explosion was a considerable increase in pressure in the boiler, made possible by the safety valve being defective in size, and a faulty boiler, presenting a large unstayed flat surface, further weakened by being cracked, the direct result of its faulty construction.

PERSONALS.

Mr. Erskine Rumsey has been appointed General Mining Engineer of the Alabama Division of the Tennessee Coal, Iron & Railroad Co.

Mr. R. H. Hilyard has been appointed Superintendent of Track, Buildings & Bridges for the Fort Worth & Rio Grande Ry., with headquarters at Fort Worth, Tex.

Mr. Charles H. Ellis, C. E., died at his home in Detroit, Mich., Nov. 30. He was born in Woonsocket, R. I., in 1841, and began his career as an engineer on the Fitchburg R. R.

Mr. Carroll Ph. Bassett recently delivered a lecture on "Sewage Disposal in Inland Towns" before the students of the Engineering School of the University of the City of New York.

Col. Edmund Hayes, M. Am. Soc. C. E., of Buffalo, N. Y., has been appointed Chief of Engineers on the military staff of Governor-elect Levi P. Morton, with the title of Brigadier-General.

Mr. Charles F. Chapman, a civil engineer who was engaged on the construction of the Chicago, St. Paul, Minneapolis & Omaha R. R. line to Superior, Wis., in 1882, died recently at Minneapolis, Minn.

Prof. James Main, for many years employed in the Coast and Geodetic Survey, died at Washington, D. C., Nov. 24, at the age of 84. He was at one time Professor of Mathematics in Edinburgh University, Scotland.

Mr. Frederick P. Thorp has opened an office at 1020, The Rookery, Chicago, to carry on a general practice as a designing, mechanical and electrical engineer. He has until recently been with the Siemens & Halske Co., of Chicago.

Mr. R. L. O'Donnell has been appointed Assistant Engineer of the Pittsburg Division of the Pennsylvania R. R., vice Mr. Victor Wierman, promoted, and Mr. G. P. McArthur succeeds Mr. O'Donnell as Assistant Engineer on the Tyrone Division.

Mr. E. St. John, who recently resigned the position of General Manager of the Chicago, Rock Island & Pacific Ry., has been elected Vice-President of the Seaboard Air Line, vice Mr. John C. Winder, resigned. Mr. St. John has been in the service of the Rock Island Co. since 1868.

Mr. W. L. Cowles, M. Am. Soc. C. E., has accepted the position of Chief Engineer of the Bridge & Building Department of the Pottsville Iron & Steel Co., of Pottsville, Pa. Mr. Cowles was formerly Chief Engineer of the Youngstown Bridge Co., and more recently has been Assistant Superintendent of the North Works of the Illinois Steel Co.

Mr. Geo. F. Meyer, for 11 years Consulting Engineer of the Delavergne Refrigerator Machine Co., died in New York Nov. 25. He was born in New York city in 1842, and studied at the universities of Geneva and Berlin, returning here in 1868, when he was employed by the late Mr. John Ericsson for some years, and later became Superintendent of the marine engine department of the Delamater Iron Works.

Mr. A. Prescott Folwell, Assoc. M. Am. Soc. C. E., of the firm of Potter & Folwell, New York and Pittsburg, was married at Glens Falls, N. Y., on Dec. 4, to Miss Helen Pear Peck, of that city. Mr. and Mrs. Folwell will visit Tampico, Mex., on their wedding trip, where Messrs. Potter & Folwell have been engaged to examine and report on the plans prepared by Mr. Sydney Smith in 1884 for a water supply system for that city.

Mr. E. B. Thomas, First Vice-President of the New York, Lake Erie & Western R. R., has been elected President, vice Mr. John King, who refused re-election on account of ill health. Mr. King had been President of the road for 10 years, and for 13 years was Vice-President of the Baltimore & Ohio R. R. Mr. Thomas was elected Second Vice-President of the road in 1888, and First Vice-President in 1890, when Mr. S. M. Fenton resigned.

Mr. Geo. S. Morison, M. Am. Soc. C. E., delivered a lecture on "Foundations" before the students of the Rensselaer Polytechnic Institute on Nov. 27, describing particularly the foundations of the Memphis bridge and other great bridges of which he has had charge. The next lecture in the year's course at the Institute will be delivered on Dec. 7 by Mr. J. Foster Crowell on "The Handling of Men." The other lecturers to follow in the course are to be Lieut. Wm. H. Jaques and Messrs. L. L. Buck, Clemens Herschel, H. G. Prout and Theo. N. Ely.

Mr. Geo. F. Simonds, M. Am. Soc. M. E., of Boston, Mass., and President of the Simonds Rolling Machine Co., of Fitchburg, Mass., was killed at Scranton, Pa., Nov. 7. He was the inventor of the Simonds rolling process, by which steel balls for ball bearings, track bolts, screws, etc., are produced by straight reciprocating dies, rolling the material between them. He had also done much work in the direction of the development of ball bearings for machinery, and was interested in processes of hardening and tempering articles of steel without deformation. He was 52 years of age.

Mr. John C. Winder, Vice-President of the Seaboard Air Line, has resigned his position. He was born at Smithville, N. C., in 1831, and entered railway service in 1850, having been Assistant Engineer on the old New York & Erie R. R., Pacific R. R. of Missouri and Albany & Susquehanna R. R. Later he was an Assistant Engineer on the Croton Aqueduct, General Superintendent of the Wilmington, Columbia & Augusta R. R., Chief Engineer of several roads in North Carolina, General Superintendent of the Raleigh & Gaston R. R., and General Manager of the Seaboard Air Line, of which latter road he was elected Vice-President about a year ago.

Mr. Carl Amsler, who died at Pittsburg, Pa., Nov. 22, was at one time in charge of the construction department of the Homestead Steel Works. He afterward went to Wheeling, W. Va., where he had charge of the erection of the Bessemer steel plant of the Riverside Iron Works, and operated it for two years. Subsequently he went to Pittsburg, entering the employ of Mackintosh, Hemphill & Co., and while there superintended the erection of a Bessemer plant at Mingo Junction, O., and of the original plant of the Duquesne Steel Works. In 1889 he entered the firm of McClure & Amsler, formerly McClure & Schuler, and retained his connection until his death.

Mr. Henry L. Bristol, C. E., died at his home in Chicago, Nov. 30. He was born at Lima, O., in 1820, and went to Chicago in 1848, taking a position on the construction of the old Galena & Chicago Union R. R. In 1857 he was appointed engineer of construction of the North Chicago Street Ry., and in 1869 entered the employ of the city under the late Mr. Chesborough, then City Engineer. In 1871 he was reappointed engineer of the North Chicago Street Ry. Co., to reconstruct the road after the fire. In 1877 he was appointed Chief Engineer of the village of Hyde Park, Ill., and in 1880 accepted a position as engineer in the Sewer Department of Chicago, which position he retained until March, 1894.

Messrs. Purdy & Henderson, Consulting Engineers, with offices in The Rookery, Chicago, and in the Have-

meyer Building, New York city, have been retained in connection with the construction of the new hotel to be built by Mr. John Jacob Astor, at 34th St., and Fifth Ave., New York city. The building will cover a lot 100 × 350 ft., and will be 20 stories high. It is intended to make it the largest and finest hotel in the world, eclipsing even the magnificent Hotel Waldorf in the luxury of its appointments. Mr. Corydon T. Purdy, the senior member of this firm, has been the engineer of a number of the largest "sky-scraper" buildings erected in Chicago during the past five years, and is well known to our readers as the author of a series of articles on the design of the metal framework of high buildings, published in Engineering News in 1891 and 1892. The contract with Purdy & Henderson for the new Astor Hotel includes the design of the steel construction, the making of all the shop drawings and the superintendence of the inspection and erection of the entire work. It is probably the largest contract of the kind ever let in the line of construction.

NEW PUBLICATIONS.

DECEMBER MAGAZINES.—In the "North American Review," Hon. Wade Hampton, U. S. Commissioner of Railways, writes on recent train robberies, which he classes as "brigandage." He says with truth that the legislation which has been proposed with reference to this evil aims merely at more severe punishment of the crime, and that it is most desirable that some means of preventing these outrages should be speedily adopted. His suggestions to that end, however, are merely that railway employees should be armed, that express cars should be made burglar-proof, a thing which is practically impossible, and that dogs should be used to track the perpetrators of these crimes. "Scribner's" has a characteristic poem by Rudyard Kipling, in which that gifted author puts into poetry the meditation of the Chief Engineer of an ocean steamship, an old Scotchman, over his beloved engines. There has been much said of the disappearance of the romance of a seafaring life when steam displaced sails; but the poet shows admirably that romance dwells in inanimate things only by reason of man's association with them, and there may be as much poetry in the pulsations of a monster steamship's engines as in the wide spreading sails of an old-time man-of-war. In the same number is a paper by H. C. Bunner, in which occurs a curious error concerning Macadam and Telford roadmaking. Mr. Bunner thinks, apparently, that the Telford construction is out of date and is no longer used by engineers, and he speaks of the hundreds of thousands of dollars wasted in New Jersey by the construction of Telford roads. We need hardly say that as a matter of fact Telford construction is largely used to-day by the best engineers, where the soil and the traffic are such as to make its use advisable.

In "The Forum" the late Comptroller of the Currency, Hon. A. B. Hepburn, writes on "The Baltimore Plan of Currency Reform," explaining just what is the scheme by which it is proposed to provide an amount of money sufficient for current business needs. Mr. Louis Ehrich discusses "Stock-Sharing" as a preventive of labor troubles. He would have the laborers made partners in industrial enterprises by paying them four-fifths of their wages in cash and one-fifth in stock of the corporation they serve. He proposes this especially as a cure for railway labor troubles; but in how many railway corporations today is the common stock a suitable investment for a poor man who gets his living by his daily wages? Col. Carroll D. Wright answers the question so frequently asked nowadays: "May a Man Conduct His Business as He Please?" His paper will attract especial attention, in view of the recent report of the Chicago Strike Commission, of which he was a member.

In "The Century" we find a paper entitled "What Has Science to Do with Religion?" which, though not on a topic which may be appropriately criticised in these columns, deserves mention here by reason of the fact that its author is Prof. Aug. J. Du Bois, of Sheffield Scientific School, whose work as a technical writer has made his name known to every engineer. In the "Review of Reviews," Mr. R. U. Johnson has a paper with the taking title "Why Not More Forest Preserves?" and Hon. C. C. Kingston, Premier of South Australia, tells of the progress of arbitration as a means of settling labor disputes in South Australia.

TRADE PUBLICATIONS.

ELECTRIC RAILWAY PLANT. Sperry Electric Railway Co., Cleveland, O. Paper; 8vo; pp. 38; illustrated.

This is a handsome catalogue of the apparatus manufactured by the company, including the Sperry truck and motor and the Sperry electric brake. The latter was described and illustrated in our issue of Oct. 18. The Sperry motor is claimed to be superior to all others in hill climbing on account of the wheels being coupled and compelled to revolve in unison. Thus slipping of the front wheels is prevented. In official dynamometer tests at the World's Fair a car equipped with this motor exerted a pull of 4,500 lbs. while standing on a grade of 12.4%. The total weight on the car wheels was 12,680 lbs. Engineers wishing to operate electric cars over excessively steep grades should find Sperry equipment of interest, according to these figures.

STEAM ROAD ROLLERS. Pitts Agricultural Works, Buffalo, N. Y. Oblong 4to; paper; pp. 16; illustrated.

This is an illustrated catalogue of the Pitts double-cylinder steam rollers, which is claimed to include the latest improvements in steam and traction engine practice. The machines are made in three sizes, weighing 10, 12 and 15 tons. The front end rests by a universal joint upon a fore-carriage carrying the roller, while two large bearing wheels are behind the firebox. The cylinders are mounted on top of the boiler, and the water tank is underneath the boiler.

SOCIETY PROCEEDINGS.

TECHNICAL SOCIETY OF THE PACIFIC COAST.—At the regular meeting on Dec. 7, Mr. W. G. Curtis will present a paper, entitled "Timber Preserving Methods and Appliances."

Otto von Geldern, Secy.

ENGINEERING ASSOCIATION OF THE SOUTH.—The annual meeting was held at headquarters in Nashville, Tenn., Nov. 8, and the President, Mr. Chas. Hermany, of Louisville, Ky., delivered the annual address. The committee to canvass the ballot for officers reported the following elected: President, Prof. W. L. Dudley; Vice-President, W. F. Foster; Secretary, W. B. Ross; Treasurer, W. M. Leftwich.

NEW ENGLAND WATER-WORKS ASSOCIATION.—The regular quarterly meeting of the association will be held in Young's Hotel, Boston, on Dec. 12. Lunch will be served at 1 p. m., and at 2 o'clock Mr. Allen Hazen will give some "Notes on European Water Supplies." It is expected that this paper will be followed by discussions upon topics to be presented at the meeting. Mr. R. C. P. Coggeshall, New Bedford, Mass., is secretary of the association.

NEW JERSEY SANITARY ASSOCIATION.—The twentieth annual meeting of the association will be held at the State House, Trenton, on Dec. 7 and 8. The papers to be read of most interest to engineers are one by Mr. J. C. Smock, State Geologist of New Jersey, on the "Extent of the Diffusion of Malarial Poison from Large Areas of Wet Land in This State," and one by Mr. Parker N. Black, of Asbury Park, on "Ventilation of Separate Systems of Sewerage." The discussion on Mr. Smock's paper will be opened by Mr. Lebbeus Ward, M. Am. Soc. C. E., of Jersey City, and on Mr. Black's paper by Mr. Carrol Ph. Bassett, M. Am. Soc. C. E., of Orange. Mr. Jas. Owen, M. Am. Soc. C. E., of Montclair, is chairman of the executive committee.

WESTERN RAILWAY CLUB.—The regular monthly meeting of the club was held at the Great Northern Hotel, Nov. 20, with President Geo. Gibbs in the chair, and over 150 members present. On the motion of Mr. Wm. Forsyth, a committee was appointed to confer with the Trustees of the John Crerar Library, to be erected in Chicago, and urge upon them the desirability of devoting the library to scientific and general engineering and railway publications. The discussion on the paper entitled the "M. C. B. Coupler in 1894," read by Mr. A. M. Waitt at the October meeting of the club, was then taken up. This discussion was of exceptional value and interest, and is abstracted at some length in another column of this issue. The discussion was followed by the report of the Committee on Interchange at Chicago. In form this report was substantially the same as the report presented at the October meeting of the club (Eng. News, Nov. 1) except that it was changed to include the modifications then suggested. The meeting closed with a short paper entitled "The Scrap Heap," by Mr. J. N. Barr, Superintendent of Motive Power, Chicago, Milwaukee & St. Paul Ry. This paper will be abstracted in another issue. At the December meeting Mr. Wm. Forsyth will read a paper entitled: "Locomotive Fuel: (a) The Heat Value of Western Coals; (b) Progress in Combustion."

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—The 15th annual meeting opened at the House of the Society in New York city on the evening of Dec. 3, with a very large attendance; the number of members registered up to noon of Tuesday being over 250. The annual session for the disposal of Society business was held on Tuesday morning. The report of the Council showed that the total membership of the Society, including 51 members just elected, is now 1,690, divided as follows: Honorary Members, 16; Members, 1,346; Associates, 71; Juniors, 257. The report of the finance committee showed that owing to the heavy expenditures in connection with printing the proceedings of the Mechanical Science Section of the Engineering Congress in 1893, the Society has run behind somewhat during the past year. The total receipts for the year were $27,355, and the total expenses were $27,455. The unpaid dues, etc., on the Society's books are about sufficient to pay all outstanding bills. The annual income of the Society from membership dues is now about $20,000, and it expended for printing, binding and salaries in the past year about $18,500.

The tellers reported the election of the list of candidates for offices whose nomination was reported in our issue of Nov. 8 (p. 385). The new President of the Society is Mr. E. F. C. Davis, Supt. of the Richmond Locomotive & Machine Works, and the new Vice-Presidents are Messrs. F. H. Ball, of Elizabethport, N. J.; Jesse M. Smith, of Detroit, Mich., and M. L. Holman, of St. Louis. The changes in the Society's constitution, noted in our issue of last week, were presented to the members for action and unanimously adopted. The technical work of the meeting was then begun by a report from the committee on Standard Tests and Methods of Testing. Two members have been added to this committee by the Council, Messrs. E. D. Estrada and W. J. Keep. The committee's report was another "preliminary" one, consisting of a monograph on tests of cast iron, by Mr. Keep. This paper described an elaborate series of tests for shrinkage and depth of chill, leaving the other features of the tests for a future paper. The paper was severely criticised by several members and strongly defended by others, and discussion upon it was finally cut short. The final report of this committee, which has been at work for several years, was promised for the meeting to be held next June at Detroit.

Following this came a paper on Steel Forgings, by Mr. Geo. M. Sinclair, of Philadelphia. The paper gave some interesting hints concerning a class of shop work with which many engineers are quite unfamiliar, and promises to be of so much use as an aid in preparing specifications for steel forgings that we shall reprint it in full in our next issue. Adjournment for luncheon was then taken. We postpone further report of the proceedings to our next issue.

COMING TECHNICAL MEETINGS.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
Dec. 3 to 7. Secy., F. R. Hutton, 12 W. 31st St., New York.
FRANKLIN INSTITUTE, PHILADELPHIA.
Dec. 7. "Mechanism of the Watch," H. E. Duncan. Secy., W. H. Wahl.
TECHNICAL SOCIETY OF THE PACIFIC COAST.
Dec. 7. Secy., O. Von Geldern, 719 Market St., San Francisco.
MONTANA SOCIETY OF CIVIL ENGINEERS.
Dec. 8. Secy., G. O. Foss, Helena, Mont.
ENGINEERS' CLUB OF INDIANAPOLIS.
Dec. 8. Secy., C. C. Brown.
WISCONSIN POLYTECHNIC SOCIETY.
Dec. 10. Secy., Geo. G. Mason, 144 8th St., Milwaukee.
ENGINEERS' CLUB OF KANSAS CITY.
Dec. 10. Secy., F. W. Tuttle, Baird Building.
CIVIL ENGINEERS CLUB OF CLEVELAND.
Dec. 11. Secy., F. C. Osborn, 721 Hickox Building.
NORTHWESTERN SOCIETY OF ENGINEERS.
Dec. 11. Secy., D. W. McNorris, Burke Building, Seattle, Wash.
NORTHWESTERN RAILWAY CLUB.
Dec. 11. Secy., W. D. Crosman, Ryan Hotel, St. Paul.
DENVER SOCIETY OF CIVIL ENGINEERS.
Dec. 11. Secy., F. Ed. King, 36 Jacobson Block.
NEW ENGLAND RAILROAD CLUB.
Dec. 12. Secy., F. M. Curtis, P. O. Box, 1576, Boston, Mass.
NEW ENGLAND WATER-WORKS ASSOCIATION.
Dec. 12. Young's Hotel, Boston. Secy., R. C. P. Coggeshall, New Bedford, Mass.
CANADIAN SOCIETY OF CIVIL ENGINEERS.
Dec. 13. Secy., C. H. McLeod, 112 Mansfield St., Montreal.
ENGINEERING ASSOCIATION OF THE SOUTH.
Dec. 13. Secy., Hunter McDonald, Nashville, Tenn.
ENGINEERS & ARCHITECTS' CLUB OF LOUISVILLE.
Dec. 13. Secy., G. W. Shaw, Norton Building.
NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
Dec. 14. Secy., D. W. Meeker, St. Par., Minn.
ENGINEERS' CLUB OF PHILADELPHIA.
Dec. 15. Secy., L. F. Rondinella, 1122 Girard St.
ENGINEERS' CLUB OF MINNEAPOLIS.
Dec. 17. Secy., E. Nexsen, Kasota Block.
WESTERN RAILWAY CLUB.
Dec. 18. Secy., W. D. Crosman, Rookery Building.
COLUMBIAN ENGINEERING SOCIETY.
Dec. 18. Secy., W. F. Hart, Washington, D. C.
ENGINEERS' CLUB OF ST. LOUIS.
Dec. 19. Secy., W. H. Bryan, Turner Block.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
Dec. 19. Secy., Francis Collingwood, 127 E. 23d St., N. Y.
ASSOCIATION OF ENGINEERS OF VIRGINIA.
Dec. 19. Secy., J. H. Pilcher, Roanoke, Va.
BOSTON SOCIETY OF CIVIL ENGINEERS.
Dec. 19. Secy., S. E. Tinkham, 36 Bromfield St.
NEW YORK RAILROAD CLUB.
Dec. 20. Secy., John A. Hill, Temple Court, N. Y. City.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Dec. 20. Secy., D. Carhart, Carnegie Library Building, Allegheny.
ENGINEERS' CLUB OF CINCINNATI.
Dec. 20. Secy., J. F. Wilson, 24 W. 4th St.
SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
Dec. 26. Atlanta, Ga., Secy., F. A. Charpiot, Macon, Ga.
WESTERN SOCIETY OF ENGINEERS.
Jan. 2. Secy., Thomas Appleton, Lakeside Bldg., Chicago.
CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Jan. 7. Secy., C. L. Annan, City Engineer's Office.
CENTRAL RAILWAY CLUB.
Jan. 13. Secy., S. W. Spear, East Buffalo Iron Works, Buffalo, N. Y.

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ADVERTISING RATES: 20 cents per line agate measure. Want notices, special rates, see page 22. Rates for standing advertisements sent on request. Changes of advertisements must be in hand on Monday afternoon; new advertisements, Tuesday afternoon; transient advertisements by Wednesday noon.

The bad results which may reasonably be expected when political mismanagement and short-sighted economy combine to influence municipal work is being brought out very clearly by the reservoir failure at Lancaster, Pa. This failure and some of the causes which led to it were described in our issue of Oct. 25. Elsewhere in this issue are given reports by engineers and a chemist called in by the city to pronounce on the reservoir as it now stands and the causes of its failure. The attempt to economize in engineering service during the construction is the chief feature of the story which was told in our issue of Oct. 25. It was at first thought that the reservoir could be repaired, but the opinion quoted elsewhere is to the contrary. After the reservoir has been completed and has failed the city fathers employ a chemist to make a mechanical analysis of the material used for the clay lining, and he says it is very poor stuff for the purpose. The engineers say that the reservoir is so poorly built that repairs are out of the question. More professional advice at the start and during the work would have made expert service unnecessary at the finish and would have saved the city from its present predicament of having a $64,000 reservoir on its hands which it pronounces useless.

The new badge adopted by the American Society of Civil Engineers at its last annual convention is in every way to be commended, and the embossed card showing this badge, which has been sent out for the information of members, bears testimony to the good taste of the committee having this matter in charge. The form of the shield is a decided improvement upon the old one and the two badges, blue for Members and Associate Members and red for Fellows and Associates, bear nothing but the full name of the society and the date of its foundation. The difficulty of finding any characteristic emblem satisfactory to all engineers was made evident in the controversy over the old badge and the pronounced dissatisfaction with the accepted design of 1884, which has led to this change. The true purpose of a badge, and its only legitimate purpose, is to provide a ready means of recognition between members, and at the same time to enable the general public to know to what particular society the wearer of the badge belongs. The latter requirement cannot be filled by a display of initial letters only, as in the old badge; and by giving the full name in neat, easily-read letters and without any confusing emblems, the present badge well fills all the requirements of a badge and shows the common-sense of the committee which selected it. The restrictions under which the new badge is to be issued will also tend to make it more valuable to the members as a decoration of distinction.

In his annual message President Cleveland recommends that the present promiscuous free distribution of public documents be abandoned, that hereafter such documents be put on sale at a price covering the actual cost and that they be given out only on personal application. This is an eminently sensible and proper suggestion. The only legitimate purpose of the vast majority of these documents is the information of the general public. If this information is of a valuable character, those interested will seek for it and will be willing to pay a reasonable price for it; if it is not of permanent and general value it is a great waste of public money to continue to print it in enormous quantity with the junk-shop as its final resting place. Several of the government bureaus now, at Washington, sell their publications and issue many of great value, covering special investigations and detailing methods and results. The English practice is an excellent one in this respect, as all official and public reports of value are on sale at a fixed price; and what is still more essential, price lists are issued of these public documents at frequent intervals and are to be had on application. This latter is the valuable feature of such a system of disposal, and if our government adopts President Cleveland's suggestion it is to be hoped that a list of this character will be made a prominent part of the new system of distribution. And the extension of this list by a brief synopsis of the contents of the volumes would be worth all it costs in time and money. Many reports of value now published are lost to those most interested simply from this lack of publicity, and a case in point is the "Manual on Topographic Methods," issued lately by the U. S. Geological Survey. The information it contained was very useful to many engineers, and the price put upon it was almost nominal; but very few knew of its existence until an editorial notice in our issue of Sept. 27, 1894, called attention to it. That one notice, writes an officer of the Survey, practically exhausted the edition; but it put the book where it belonged, in the hands of interested readers. The present system, or lack of system, represents a maximum of wasted effort and money and a minimum of benefit to the public, and it should be stopped at once.

ORGANIZATION OF A CITY ENGINEER'S OFFICE.

In asking us to discuss editorially the problems set forth in his letter, published in this issue, our "City Engineer" correspondent opens up a subject of very broad dimensions. It is one upon which opinions will differ as prevailing conditions modify the views of writers upon it, and it is very doubtful if any set of rules can be formulated applying with equal force and completeness to all city engineers' offices. Its proper discussion and disposal is a part and parcel of the whole scheme of municipal government, and any reform in the engineer's office, as a rule, must be preceded by radical changes in the entire system. As it is, every city engineer must endeavor to make his office as efficient and himself as valuable as an engineer to the city he serves as the means at his command will permit; and to this end a discussion of methods and detail among city engineers themselves would be likely to throw out useful hints and to correct faulty practice, and for a series of articles of this nature we would freely open our pages.

Proper office organization will depend very largely upon the previous professional experience and personal characteristics of the City Engineer himself; at least as far as office routine and the qualifications and duties of his assistants are concerned. The number and salary of these assistants, however, will depend chiefly upon the public spirit and wisdom of those who appropriate the means to pay the engineering staff. Other things being equal, the services of a city engineer become more valuable as he grows more familiar with his duties and the local conditions under which his work is to be performed, and from this standpoint his tenure of office should certainly not be a short one. In many cities this tenure is practically one during good behavior, though the engineer may be officially reappointed every year; and as long as this power of annual appointment is only exercised for the best interests of the city, and without political or personal bias, it is well enough. But as the power of removal as well as of appointment should always be vested in the individual or body held generally responsible for the conduct of municipal affairs, it is difficult to see how any arbitrary term of office can be fixed.

In answer to the query relating to the creation of a street department, separate and distinct from the engineering department, it may be said that all public work, of every kind, should be under one responsible and competent head. This responsible chief may be called a City Engineer or a Director of Public Works; but in either case he should be responsible only to the appointing power; should be an engineer selected for his executive ability as well as technical attainments, and should have full control of his subordinates. The detail of this public work could then be divided up under separate bureau chiefs, all acting in concert and under the direction of a common chief. This seems to be the only way of avoiding endless friction in the conduct of work; wasted effort and wasteful methods in expenditure. A Board of Public Works, made up of good and well-meaning citizens, but of men unfamiliar with engineering methods and the true duties of the office, will not meet the demand. The St. Louis plan, however, is an excellent one, inasmuch as the three members of its Board of Public Works are all able engineers, actively taking part in the technical as well as official duties of their office.

The subject of contract vs. municipal work is one depending too largely upon the factor of common honesty in man to be fully answered anywhere. As a rule, contract work is the most satisfactory, when such work is conducted under honest and capable management on the part of the city. Cases do exist in public work where the difficulties to be encountered are very great and the ultimate cost must simply be guessed at. It does not seem fair to demand that a contractor shall take these risks, and pay for his want of luck in guessing if he guesses wrongly, and under such conditions it would seem better and ultimately more satisfactory to do what is to be done directly at the cost of the city. But, aside from such cases, contract work would seem best; for though corrupt officials may nullify any safeguards placed about a contract, these same officials would probably cause the city more loss and greater delay under a system of direct city work, with all the avenues for rascality such a system opens. And even did corruption not exist, in the latter case, there is another element quite as likely to do damage to the taxpayer, and that is politics. When the city manages the job and pays directly for labor and material, the politician will fill places regardless of qualification; the superintendence is likely to be inefficient and careless in proportion, and there will be a minimum of efficient labor effort and a resultant increase in cost and delay in completion.

It is very evident, from what has been said, that the organization of the engineering department of a city depends very largely upon the efficiency in methods and honesty of purpose characterizing the whole municipal government. No satisfactory and complete rules for the engineer can be formulated which do not take the whole system into account. The questions put by our correspondent admit of wide discussion; but, in the end, this discussion will avail little unless the entire subject of municipal government is handled at the same time. There is much more direct mutual profit in detailing individual experiences in the execution of public works, and in the free discussion of office methods. The solution of the greater problem will come in time, as time develops the glaring faults in our present system of city government: faults which are among the direct results of a too rapid growth in cities and too little public interest by citizens in public affairs.

Since the above was in type we have received the published papers on the organization and management of City Engineer's offices, lately presented to the Boston Society of Civil Engineers, and also the report of Mr. W. S. Bacot, M. Am. Soc. C. E., upon a proposed reorganization of the Public Works

Department of the city of Burlington, Vt. Abstracts from these are given in this issue, and while their general tendency is in the direction of the advice given here, the subject is treated in more detail and the reader is referred to them for much useful information.

In large cities, as well as in smaller cities and towns, it is being realized more fully than formerly that the character of the public work performed and its cost will depend largely upon the good judgment, technical knowledge and experience and upon the executive ability and honesty of the engineer in charge. This holds good regardless of the attempts which other city officials, honest and well intentioned, but ignorant of technical matters, may make to closely supervise work on their own account.

If these officials, in an attempt to economize, see fit to employ a cheap or an incompetent engineer, they very generally pay an extravagant price for imperfect or unsuitable work, and in so much betray the trust reposed in them by their fellow-citizens.

That there is need for reform in municipal organization, and especially in the engineering department, is shown in a striking manner by the effort now being made in San Francisco, Cal., to organize for the first time in its corporate existence a City Engineer's Department. With a population of 300,000; a total expenditure to date of $31,000,000 for streets, sewers, etc., and an annual appropriation of $1,500,000 for similar public work, this city has not now and never did have an engineer officially and regularly connected with its government, so far as we can learn.

In the larger and more progressive cities the tendency now is to place all engineering work either under a board of two or three expert engineers, with one acting as the president of the board, or under a City Engineer, who has absolute control over his bureau chiefs, who must also be engineers expert in the special duties of their bureaus. The first is the so-called St. Louis plan and the second is found in the organization of the City Engineer's office of Providence, R. I. This is decidedly a move in the right direction; but it means a complete revolution in the municipal machinery of the majority of American cities, and the reform must begin by a reorganization of the entire system of government. It means a very large reduction in the number of offices that may be parcelled out to mere political workers; but it also means systematic co-operation between the various bureaus, which, with the best intentions, is too frequently impossible under prevailing conditions. It also means the planning and supervision of this work by competent and experienced men, with an improvement in its quality and a decrease in its cost. The centering of control and responsibility for all public work in a competent and experienced civil engineer is the only method by which this work can be properly and economically carried out. The difficulty, at present, is to make the men whose personal interests lie in another direction realize this fact.

As there are nearly 400 towns in the United States having a population of between 8,000 and 50,000, it is evident that the engineering organization of these smaller places is an important element in the problem. In many of them the volume of work is not sufficient to employ more than one experienced engineer; and in others even this one man would not be engaged upon city work all of the time. The present common practice in such places of engaging the services of any local surveyor or engineer by the day is to be strongly condemned, especially if different men are employed at different times. Such a practice inevitably fosters local jealousies, and often leads to the concealment, removal or falsification of plans, records and bench marks and the utter absence of any public and permanent record of work performed. Mr. Noyes suggests the employment of the best local engineer at a per diem rate, with the understanding that he is to do all the city work, but can also take any outside work which does not interfere with his public duties. The chief objection to this plan is that he is called upon to serve two masters, the city and his private clients, and their interests are sometimes diametrically opposed. It would seem better to engage all the time of the best available man at an annual salary, graded according to the experience required; and where the average duties do not demand the constant services of a high-priced man of wide experience, let the municipality engage a competent consulting engineer to advise, approve plans, and at stated periods examine the progress of any work of unusual importance. When it is properly figured out, it is a very insignificant piece of public work that could not well afford to pay for the consulting engineer; and his fees are trivial when compared with the blunders that may be thus avoided and with the gain in efficiency in plan and economy in construction.

City government is business, not politics, as a writer upon the subject expresses it, and the relation of the engineer to the city government may be thus briefly stated: Select the most competent engineer that the rank and revenue of the city will permit, and see to it that he possess common-sense and executive ability as well as sound technical knowledge and experience. If you cannot, or think you cannot, afford to pay the salary such a man is worth, get the best man you can afford to pay, but have his plans approved and his work directed by a thoroughly experienced consulting engineer when any unusual expenditure is demanded. It will pay. When common-sense and the importance of the public work combined dictate the employment of the really competent city engineer, place all engineering work of every description under his responsible charge; allow him to select and discharge his own assistants and to regulate his own office; and, finally, pay him a good salary and keep him as long as he shows a live interest in the engineering interests of his office and properly performs his many duties.

And one word more to the authorities appointing city engineers: Do not suppose that the interests of the city are fully served in appointing a competent city engineer at a fairly good salary, with the expectation that he will do all the work, and that his salary, and that of a couple of chainmen, will represent all the expenditure of the city engineer's office. Measured in dollars there is true economy in a more liberal expenditure. That the city engineer may do his whole duty in the larger cities, he must have assistants fitted for the responsibilities put upon them, and they must be paid accordingly. He must have a properly arranged office fitted for the filing and preservation of plans and records, and he must have the time or assistance necessary for properly keeping up these records. The duties of his office are multitudinous, especially under the plan here recommended, and much time, which costs the city money, and costly surveys to regain lost information, are saved constantly by the systematic arrangement of a well-organized engineer's office. These are facts appreciated by all city engineers, but too often overlooked by those who appropriate the money for running the office of the City Engineer.

LETTERS TO THE EDITOR.

ORGANIZATION OF A CITY ENGINEER'S OFFICE.

Sir: I am anxious to see discussed the proper organization of a city engineer's office—I mean with regard to the engineer and his subordinates, salaries, method of appointment of engineer and his assistants, qualifications demanded, tenure of service, etc. Also what work should properly be under the supervision and control of the engineer department? Should a street department be separate and distinct from the engineering department; and is it wise to use contract labor in the execution of municipal work?

I should be glad to see these questions discussed in the columns of your paper and by yourself editorially.

A City Engineer.

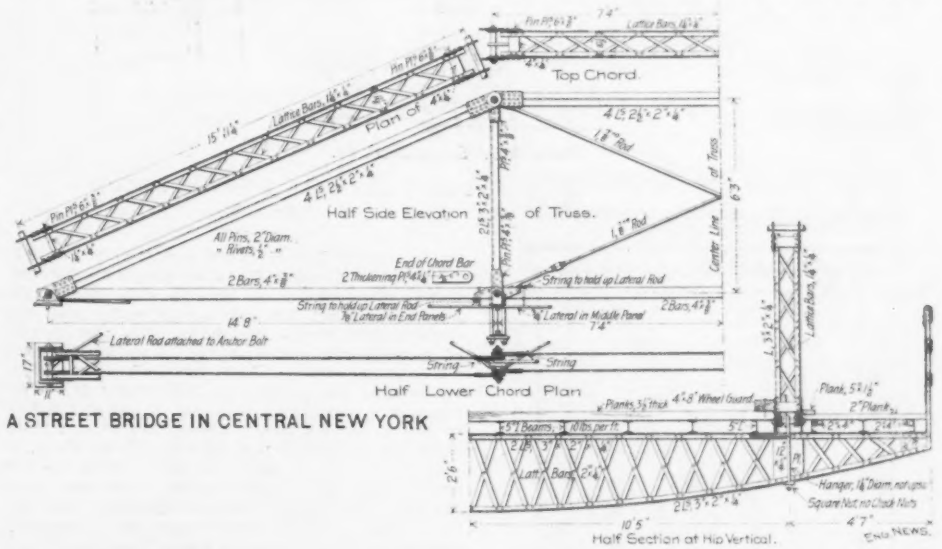
Oct. 27, 1894.

(We have answered this letter in our editorial columns.—Ed.)

TWO SPECIMENS OF "ECONOMICAL" BRIDGE CONSTRUCTION.

Sir:—I send you herewith details of a highway bridge which, it seems to me, are worthy of being handed down to posterity as illustrating the latest advances in economical construction. The bridge is only a small affair (about 45 ft. long), but is interesting as a study in how to make the least amount of metal cover a given opening. It is located in a thriving village in central New York and was built only about a year ago. The modesty of the builder in omitting a name-plate prevents me from giving him the fame he deserves.

This bridge crosses a small water-course on a street where the traffic is sufficient to demand a 20-ft. road-



A STREET BRIDGE IN CENTRAL NEW YORK

amount, though not normally of a very high character; but in the event of obstruction on a couple of neighboring streets the very heavy traffic of a number of mills and factories would be thrown on this structure; and it is also liable at any time to be covered by a crowd of people as a result of any local excitement. A bridge thus situated should not be proportioned for a moving load of less than 100 lbs. per sq. ft. This bridge will carry that load, though with the trifling drawbacks that the stress in the lower chord will be 21,700 lbs. per sq. in., and in the middle panel diagonals 29,100 lbs. per sq. in.; and that the factor of safety in the top chord will be 1.7, and in the end post 1.36. For a safety factor of 4, which some people consider quite important, the moving load capacity of the bridge is about 23½ lbs. per sq. ft. Little matters like pin bending, etc., are not considered when designing a bridge on the broad ground of economy.

Besides the general delicacy of its proportions, you will note the ingeniously economical arrangement of all the details. The idea of a single anchor bolt, also made to do duty by holding one end of the end lateral rod, is new, to me at least. The use of a string to hold up the ends of the bottom laterals, instead of a piece of stove-pipe wire, is also an economical innovation.

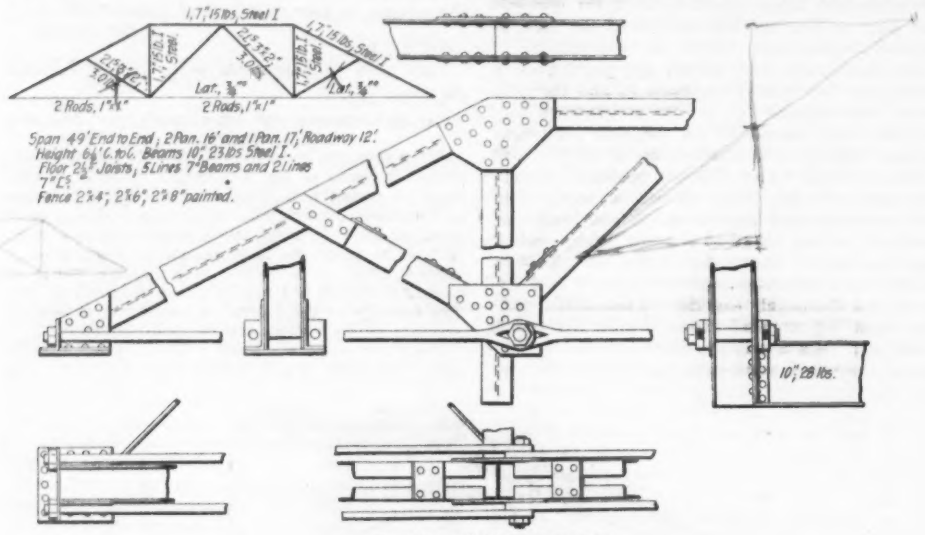
Some years ago a work on bridge building was published, wherein many of the devices resorted to by unscrupulous builders were explained at length. It had a deservedly wide circulation, though its purchasers did not all put it to the use intended by the author. At least one bridge builder bought the book, keeps it in a handy place on his shelf and considers it a good investment; for, as he explains, it not only mentioned all the old tricks with which he was already acquainted, but told of several new ones which he knew nothing about before, and which he thought could be turned to good account. I trust this gentleman, and perhaps some others, may find this bridge a profitable study.

If there are any who have not gotten on to all the fine points of "fin-de-siecle" construction they may learn from this illustration how to catch up with the band.

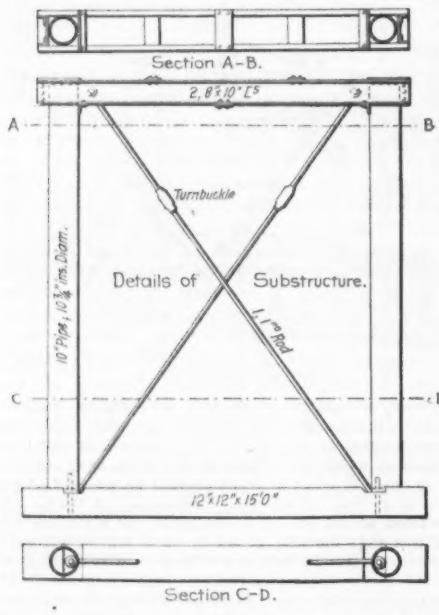
It is hardly necessary to say that an engineer's services were not considered necessary in the construction of this bridge.

Yours truly, Chas. F. Stowell, M. Am. Soc. C. E.
Albany, N. Y., Oct. 27, 1894.

Sir: Enclosed please find a copy of a bridge plan which is forwarded to you as a curiosity. The drawing is not quite complete in that the approach to the bridge


1,7" 15 lbs. Steel I
1,7" 15 lbs. Steel I
1,7" 15 lbs. Steel I
2,8"x10" E.S.
2,8"x10" E.S.
Lat., ⅞"
Lat., ⅞"
2 Rods, 1"x1"
2 Rods, 1"x1"
Span 49' End to End; 2 Pan. 16' and 1 Pan. 17'; Roadway 12'.
Height 6' 6" c. to c. Beams 10" 23 lbs Steel I.
Floor 2½" Joists; 5 Lines 7" Beams and 2 Lines 7" E.S.
Fence 2'4"; 2'6"; 2'8" painted.
10" 28 lbs.

Details of Superstructure.



is not shown. There is to be one panel of approach at each end of the bridge, 14½ ft. long. It will be made by extending the joists for the bridge and resting the ends upon wooden bents. This plan, we are informed, was placed on file with a County Clerk in the State of Missouri by a bridge company doing a general bridge and structural iron business. Yours truly, C. D.
Nov. 10, 1894.

PLANS FILED FOR A HIGHWAY BRIDGE IN MISSOURI.

THE "ECONOMY" OF GOOD FOUNDATIONS FOR PAVING.

Sir: A controversy having arisen between the Board of Street, Sewer and Drain Commissioners here and myself as to the necessity for some foundation for block paving laid in our streets, I beg leave to solicit your valuable opinion in the premises.

Our natural surface is a loamy sand generally, with occasional thin layers of clay, and where low places have been filled in we encounter the usual rubbish found in such instances. At a depth of 5 or 6 ft. a stratum of very fine water bearing sand is encountered, which carried the ground water to within 3 or 4 ft. of the surface, until our sewerage system, with its drains, lowered it to the depth of the drain pipes. The city, when I came here, was paved with poor cobbles, and in some instances with granite spawls, which required relaying on an average every five years, and the councils wisely determined to abandon such work. Granite block was adopted, and the first street laid with this, even with a good bed of sand, was far from satisfactory. I, of course, knew that a concrete base was pre-eminently the proper foundation to adopt, but owing to our distance from suitable stone, and the great cost of the concrete, I was forced to use some other less expensive plan. Experimenting with a cobble-stone foundation, I found it to give good results, the roadbed being excavated and the cobbles relaid and thoroughly rammed at such a depth as to give about 2 ins. of coarse, gravelly sand under the superimposed block. Such a pavement last year cost us $1.85 per sq. yd., including everything. All the materials and one-half the labor cost $1.00 per sq. yd., which would give only 25 cts. per sq. yd. for the foundation, even when it is charged with one-half the labor. But filling material is very scarce here and costs us about 65 cts. per cu. yd. The 4,500 cu. yds. of material obtained from the above work, placed where it was required, should then be a credit against the cost of the foundation. There being 11,800 sq. yds of this foundation, we would in this way reduce its cost 24 8-10 cts. nearly, leaving only about 2-10 ct. as its cost per yard, or less than $25 for the whole.

As is the case in most embryonic cities, we are afflicted here with many experts, who have been claiming, through the press and otherwise, that this foundation is entirely unnecessary and a frightful expenditure of the "people's money," and finally our most estimable Mayor has been led into writing to the Board aforesaid the enclosed letter, which has caused them incontinently to condemn the employment of any foundation whatsoever for block paving, and to direct its abandonment forever.

At their request I submit the matter to your judgment, and desire that you shall unhesitatingly condemn my methods if, in your opinion, they deserve it.

Very truly yours, W. T. Brooke,
Norfolk, Va., Nov. 23, 1894. City Engineer.

The letter of the Mayor enclosed is as follows:

Mayor's Office, City Hall,
Norfolk, Va., Nov. 22, 1894.

Hon. Board of Streets, Sewers and Drains, Norfolk, Va.:

Gentlemen: Has it never occurred to you that it is wrong to waste the people's money by burying it 2 ft. beneath the surface of the city? And don't you think that we have had quite enough of such funerals in Norfolk, with a depleted treasury as the result of such waste?

In passing down Main St. yesterday I found a gang of men digging out Chapel St. for the purpose of repeating the act of burial of the city's funds, so much needed for other purposes. The city cannot bear such a needless and unnecessary waste. Enough money has already been wasted in double-paving to put the streets of our city in good condition. If you purpose going in the same old ruts as the former boards, in what manner or in what way will you show your reform?

As the Mayor of the city I cannot sit idly by and see what I believe to be a useless expenditure of money after such a manner, and without any justifiable reason, and hold my peace. Do put a stop to such doings, and let the people see that you are the right men in the right place, and that double paving with you will be a thing of the past, never to be repeated by this administration.

Very respectfully, Chas. W. Pettit,
Mayor.

(From our correspondent's statement of controlling conditions, coupled with some personal knowledge of the soil usually found under the streets of Norfolk, we would unhesitatingly commend the course pursued by the City Engineer as a wise one under the circumstances. A good foundation is more essential than a good surface in street paving, and it is impossible to maintain any street surface in good condition without endless and expensive repairs, unless an unyielding base is provided. As first cost forbids the use of concrete, the employment of the old cobblestones in the manner proposed is the next best thing, and at the figure named they are worth many times the cost of putting them there. They assist in distributing the load over the yielding soil and will increase the life of the pavement, and thus ultimately much decrease the cost. Has it never occurred to the estimable Mayor of Norfolk that there are other and much more effective ways of "burying the people's money" than by the method objected to? It was certainly wasteful of public funds to relay a cobble-stone pavement every five years and have a very poor pavement in the intervals; and it is as certainly more wasteful to repeat this experience with a more expensive type of paving material to start with. Even the excuse of a depleted treasury is no valid excuse in this case, for the first cost of the foundation material is exceedingly small when compared with the saving in maintenance to be secured by its use. Our friendly advice to his Honor and to the many "experts" is to leave engineering to those who make a business of it, and the much-sought-for economy may be trusted to follow.

ORGANIZATION AND MANAGEMENT OF A CITY ENGINEER'S OFFICE.

A number of papers upon this subject were recently presented to the Boston Society of Civil Engineers, and are published in the November issue of the Journal of the Association of Engineering Societies. From these papers and the discussions upon them the following matter is abstracted:

In the first paper Mr. Albert F. Noyes, City Engineer of West Newton, Mass., takes up the subject of methods to be pursued in small towns which have not enough engineering work to do to warrant the steady employment of even one good engineer. He suggests that in such cases the services of the best local engineer or surveyor be secured at a fixed rate per diem for all engineering work required. He should be at liberty to do such private work as will not interfere with his public duties, should have an office in a public building, and should be held responsible for the proper filing, indexing and preservation of all plans and records. He should be called the city or town engineer. When the character of any special work requires the services of an engineer of broader experience than can thus be obtained, the town engineer should be permitted to call in a consulting municipal engineer, selected for his wide experience in work of the character under discussion and able to quickly grasp the nature of widely-varying local conditions. This consulting engineer could be retained by a number of small towns, and should be expected to visit them and examine their public works at intervals, advise with the town engineer upon the minor details of office management and approve plans for work to be done.

For cities of a higher class Mr. Noyes approves of the St. Louis plan of managing public works, by a board made up of three expert engineers, each in charge of a division, and called commissioners. These commissioners meet as an executive body, each one has a voice in the direction of work and their deliberations are presided over by the Engineer Commissioner, who is the president of the board. Next in merit to this method comes the Providence plan, which will be explained more fully later.

Mr. Wm. E. McClintock approved of Mr. Noyes' suggestions and stated that by acting as a consulting engineer to a town engineer who had designed a scheme of sewage he had been enabled to save a community $200,000 in the cost of construction by utilizing natural water courses for removing storm water, and thus reducing the size of the sewers. It should be said that in this case the town engineer was simply obeying the orders of

the town authorities, who demanded a combined system.

Mr. Orin F. Clapp described the City Engineer's office of Providence, R. I. Mr. Charles E. Paine was the first City Engineer and entered upon his duties on Jan. 1, 1872. Until the completion of the water-works, in 1877, the engineering work was scattered under several heads. On Feb. 5, 1877, Mr. Gray out of the original City Engineer's office and the departments were consolidated. The water and sewer departments remained practically as they had been organized by Mr. J. Herbert Shedd, but all the other departments were organized by Mr. Gray out of the original City Engineer's office. Though the direct control of this office passed, on May 2, 1890, from the City Council to the Commissioner of Public Works, when Mr. Shedd was made City Engineer, the organization of the office has remained practically the same as when it was organized in 1877. It consists of a City Engineer, appointed annually by the Commissioner of Public Works and confirmed by the City Council, a chief clerk and two assistants, and an average of 69 engineers and students distributed among the following seven departments: Bridges and Harbor, City Property, Highway or Grade, Parks and Public Buildings, Sewer, Street Line, Water. The duties of these departments are described as follows:

I. Bridges and Harbor.—All bridges under the care of the city are examined annually; plans and estimates for all new bridges are made and also repairs for old ones; detailed accounts are kept of all expenditures on each bridge; all maintenance and repairs, usually done by day work, are made by a force permanently employed by this department; and, finally, all pay rolls are made out for all employees, such as keepers, engineers, carpenters, laborers, etc. This department has a self-registering tide-gage and carefully preserves the records. It makes a separate annual report to the City Council.

II. City Property.—This department surveys each piece of property bought, sold or exchanged by the city; makes maps of such properties for record; looks up titles and writes the deeds; marks by stones the corners of city land, etc.

III. Highway or Grade.—This department prepares all plans and profiles for defining street grades, and when these are established by the Board of Aldermen it makes finished plans for the City Clerk for record. It marks all grades for houses and fences, for constructing and curbing streets, paving gutters, etc. It prepares plans and estimates for building or rebuilding streets; makes curbing assessments and measures all work done by contract.

IV. Parks and Public Buildings.—This department prepares all plans for the treatment of minor parks; stakes out all constructions on the same and measures the work done; makes plans for improving school estates, building retaining walls, grading, draining, etc., for the Committee on Public Buildings. It also stakes out lots, paths, etc., for the North Burial Ground, owned by the city.

V. Sewer.—In this department are prepared all general sewerage maps; estimates are made of the cost of sewers, as called for by the Sewer Committee, and plans and specifications for sewer work are prepared. It looks after the engineering and inspection during construction; makes estimates, bills for extra work, pay roll of inspectors, etc. It keeps office records of all work done and has general supervision over inspectors of private drains and keeps a record of these drains for general use. It makes plans and calculations for sewer assessments and controls sewer maintenance. This department now has charge of the Improved Sewerage System, under construction, under a special appropriation.

VI. Street Lines.—This department makes all surveys for laying out new streets, and for widening, straightening or relaying old streets. It makes plans for record of street lines and gives lines for buildings or fences abutting on the streets.

VII. Water.—This department makes all plans and estimates for water-pipe extension; gives grades and lines when necessary; fixes the size of service pipes and keeps a record of all work done, water used, analyses made, etc. It has general oversight of the pumping stations, reservoirs, etc.; keeps and tabulates the meteorological records; experiments upon the filtration of water, etc.

During the last year the average number of persons employed in these departments was as follows: Bridge Department, 8; City Property, 4; Parks, 8; Highway or Grade, 11; Street Line, 4; Sewer, 24; Water Department, 10. These employees are appointed and their compensation is fixed by the Commissioner of Public Works upon the recommendation of the City Engineer; but both the appointments and the rate of pay have to be approved by the Board of Aldermen.

With one exception the present heads of the departments have held their positions since the organization and several of the principal assistants were then members of the staff. The others holding positions have been promoted from students in the office. These students are admitted for three years on a nominal salary. During the last four years the average number of persons employed in the office has been 56 and the average annual expenditure was $52,772.45. The area of the city is now 10,300 acres, with a population of 148,942. Within the last four years special loans of $1,200,000 have been spent on the construction of highways and $1,531,890 have been spent on the Improved Sewerage System. The question of placing the designing and construction of all public buildings in the hands of the City Engineer is now being agitated.

The ordinance of 1877, fixing the duties of the new City Engineer, began as follows: "The City Engineer shall perform all such services for the city of Providence as properly come under the direction of a civil engineer or surveyor. He shall be consulted on all matters relating to public improvements of every kind where the advice of an engineer or surveyor would be of service."

Mr. Lewis M. Hastings, City Engineer of Cambridge, Mass., then took up the subject of the preservation of plans and records, and laid great stress upon the importance of their proper preservation. Mr. John T. Desmond objected to the plan proposed by Mr. Noyes of a per diem pay to engineers in small towns. He said that much of his time would be taken up in attending meetings, answering questions, etc., and for this he received no pay. He thought it would be better to pay an annual salary covering all the service required; and under the plan proposed the engineer would find himself serving two masters, the city and the public; at times a very difficult task.

Mr. G. A. Kimball recommended the collection of reliable data and its arrangement in proper form for reference, as tending to make the City Engineer's office more valuable to the city government and to the public. A library of carefully selected engineering works, arranged and indexed for ready reference, would exert a beneficial influence upon all consulting the office for information. He referred to the large library in the office of the City Engineer of Boston as a model of what such a library should be. He said much public money was wasted in making structures "strong enough anyhow," simply because the trouble is not taken, or the knowledge and experience are lacking, to properly design the structure for the work to be done. He referred to the varying thicknesses given to brick sewers of similar diameter in different cities and to the widely varying cost of granite pavement. It should be the purpose, and is the duty, of the City Engineer to prevent excessive cost in construction and maintenance of public works. And it should be the aim of every city to secure a city engineer capable of performing this duty, and he should be liberally paid. As to the practice of doing city work by day's labor, under political influences, Mr. Kimball said that a careful account kept in one city showed that the cost of certain sewers was enhanced 35% by this method as compared with contract prices.

The methods of indexing office plans was discussed at very full length by Mr. Hastings, Mr. Clapp, Mr. Henry D. Woods and Mr. Edward P. Adams; but space forbids going into that detail at this time. Mr. Wm. E. McClintock then read a paper upon "City Surveys," pointing out the importance of thoroughness and accuracy in methods employed. Mr. Fred. Brooks heartily approved of drawing a set of north and south and east and west lines on all municipal plans, as suggested by Mr. McClintock. These lines enable any one to better understand the map, and facilitated copying, enlargement, reduction, etc. Mr. Brooks also advocated the drawing of municipal plans to decimal scales, and explained at length the purpose and advantages of such a system. The subjects of assessors' maps was taken up by Mr. George A. Nelson, and the proper method of keeping records in the office of a water-works was discussed by Mr. Dexter Brackett. But these papers, with some others equally interesting, must be omitted here.

RECENT EXPERIENCE WITH THE M. C. B. COUPLER.

Some unusually interesting and valuable testimony regarding the behavior of the Master Car Builders' type of coupler under tests and in actual service was brought out in a long discussion at the November meeting of the Western Railway Club. This discussion was prompted by the paper entitled "The M. C. B. Coupler in 1894," read at the October meeting of the club (Eng. News, Nov. 1) by Mr. A. M. Waitt, Master Car Builder, Lake Shore & Michigan Southern Ry., and was participated in by a number of prominent railway motive power officials and coupler manufacturers. We abstract the principal facts brought out in this discussion, as follows:

Mr. G. W. Rhodes (C., B. & Q.)—There is a class of breakage that has not as yet received much attention in shop tests, viz.: failures due to blows and jerks which occur when cars of different heights are coupled together, and when practically but one lug of each knuckle is engaged or buffed against. The Interstate Commerce Commission has allowed a variation of 3 in., viz.: maximum empty, 34½ ins.; minimum loaded, 31½ ins. We have lately had measured in Chicago, without any especial selection, two cars each of between 30 and 40 different car owners, fitted with M. C. B. couplers—all bars were measured from the center of the knuckle-opening to the top of the rail. The following figures were obtained: (The tables, which give the figures of each car measured in detail, show that out of 94 cars, the location of the couplers came within the above limits on 65 cars and without the limits on 29 cars.—Ed.) In regard to the character of the material used or to be used in bars, I am not prepared to go quite to the extent of the statement in the paper. No one attempts nowadays to make a knuckle of malleable iron. Why? Because the strength is not in the metal. But, someone will say "malleable iron is quite strong enough for the drawbar." Then why propose to increase the shank from 5 ins. to 6 ins.? Surely this must be to make the bar stronger. In place of making such a radical move and adding additional weight to an already too heavy construction the advocate of cast steel will naturally ask, why not use a metal for the drawbar that most malleable iron manufacturers admit is the strongest for the knuckle? We fully believe this is what we would eventually come to were it necessary to always concentrate both buffing or pulling strains on the unfortunate drawbar. But I do not believe this is the case. It is only the poorest kind of construction that makes it necessary to have the bar do both buffing and pulling. When those who are responsible for the present crude condition of things realize the great expense that it is putting upon the cars we will have buffers for buffing work and drawbars for draft work. Buffers formerly used to be very general on the equipment of almost all the cars in the East, and drawbars weighing 100 lbs., and the lightest kind of draft rigging, were considered quite admissible. With the introduction of the M. C. B. bar, curiously enough, buffers were almost everywhere abandoned, and the narrow short horn back of the drawbar was considered a sufficient substitute. But a change is coming now, and has been gradually coming for several years. Some of the lines in the East have learned, if they did not know it before, the cost of maintaining equipment without buffers, and are again beginning to apply them. The private car owners are following suit, and, best of all, one at any rate of the coupler manufacturers is putting on the market spring buffers for freight cars. This latter, we believe, is a great step in the right direction. It will tend to do away with the ponderous drop test blows that have seemed almost a necessity, and will enable manufacturers to lighten rather than add to the weight of the already quite sufficiently expensive M. C. B. automatic drawbar.

Mr. J. N. Barr (C., M. & St. P.)—I have a record of the number of couplers broken and removed on my

road during the first ten months of 1894. The following is a partial summary of the figures:

	No. couplers applied.	No. couplers removed.	P. c. couplers removed.	No. br'k'ges of guard arm.
Janney, malleable iron...	14,584	902	6.18	671
California, steel.....	2,564	12	0.47	1
Gould, malleable iron....	1,182	40	.38	8
Chicago, steel.....	182	15	8.24	9
Columbia, malleable iron.	472	23	4.87	14
Mather, " "	200	6	3	...
Drexel, steel.....	180	2	1.12	None

We also have five miscellaneous couplers removed from C., M. & St. P. cars during the same period, which miscellaneous couplers were doubtless put in place of other couplers and represent some broken couplers of the other kind. In the case of knuckles broken and removed, we have of the Janney, 8.08%; California, 2.83%; Chicago, 14.83%; Columbia, 1.48%; Mather, 15%; and Drexel, 5.06%; and miscellaneous, 20 knuckles. The principal breakage in the knuckle is the pin hole of the upper lug, 455 out of a total of 1,377. The next important breakage is broken upper lug, 359 out of a total of 1,377. To the best of my knowledge and belief, the information here given is fairly correct.

Mr. C. A. Schroyer (C. & Nwn.)—In 1890 we commenced to apply the automatic couplers to our cars. During that season and the following spring and summer there were 2,050 cars fitted up with the couplers. In August, 1891, we established a form of report which was put in the hands of every one of our car repairers, and on this report there was a blank space to be filled in, showing all the details of the breakage, and a drawing on which they were to indicate the nature of the breakage. Our reports show that at that time we had on one of our divisions, where the cars ran exclusively by themselves, 2-10 of 1% of the bars broken per month. That was during the month of August, 1891. On the balance of the system there were about 1,100 of the cars running, and there we had 2% of the bars broken. In a word, where the cars were running together there were 2-10 of 1% of the bars broken, and where they were running indiscriminately 2% broken. The figures continued decreasing, month after month, until to-day, when we have 15,000 cars equipped with the automatic bars, the breakage of the bars on cars running indiscriminately, is 2-10 of 1%, or just what it was when we started where the cars ran together. Where the cars are now running together the percentage is a very small thing, it does not average over 1½ cts. a car per month for replacement of breakages, while on the other cars it averages 4½ cts. per car. We have also kept the cost of maintenance of this equipment as against the link and pin bars, with the links and pins, and we notice that the breakages are steadily getting less in the M. C. R., and the cost of maintenance of the links and pins is constantly less.

Mr. Wm. McConway (The McConway & Torley Co.)—I am not a believer in drop tests for the Janney coupler as indicating its actual strength in service, because the results under the drop bear no sort of relation to results observed in actual service. Under the drop the fracture is, as a rule, in the shank. In actual service out of every 100 breakages, 5.44 only break in the same section; or to state it otherwise, 230 couplers must run one year for one shank breakage. This result is taken from our latest tabulation based on all the breakages attending the service of 340,782 couplers in service an average of three years and four months. I am not a believer in the pulling test of the Janney and am influenced by the same cause. In the pulling machine the failure is at the point of the knuckle [illegible] service at a cost of 37.39 cts. per car per year. The shank failures of these couplers according to the same tabulation is one breakage for every 526 couplers in service one year. This we consider a favorable showing, but while the number is large enough to give a respectable average, the term of service is not sufficiently extended to warrant a full acceptance of these figures as conclusive. In this matter we deal exclusively with known facts. We know that there are just that many couplers in service, and we know the exact sum which we have received for repairs. In equating the time we have allowed one month from the time the coupler leaves our works for it to get upon a car. It will be observed that from our standpoint the calculation is a very simple one. We are not in the position of the car owner, who must guess how many of his cars are off his own line and how many foreign cars he has in exchange; everything concentrates with us as in a clearing house; and the regularity of the current figures from month to month and year to year gives us the same confidence in them as attends insurance tables. While I do not agree with Mr. Waitt as to the necessity for an increase in width of the shank to 5½ ins., I am bound to say that some of the reports which he has laid before you would indicate a necessity for some remedy in many cases.

For the benefit of those who may desire to examine and compare statistics more in detail, I append two tabulations, showing (1) the annual percentage of the various classes of breakages in the draw bar for the period between Nov., 1886, and Oct. 31, 1894; (2) the annual percentages under the same classification for the period between Jan. 1, 1893, and Oct. 31, 1894, of the coupler which we designate as our model of 1893-94. I place these figures side by side for convenience of comparison. From them it will be seen that we have fairly good grounds upon which to claim a material improvement, notably in guard arm breakages.

Percentages of Breakages of All Janney Couplers in Service Due to Various Causes.

	Percentage rate per annum of total couplers in service.	
Cause of breakage.	Nov.,1886,to Nov., 1894. Per cent.	Jan.1,1893,to Nov., 1894. Per cent.
Arm off.....	3.44	0.23
Arm cracked.....	0.92	0.15
Arm chipped.....	0.83	0.12
Face cracked.....	0.18	0.08
Back cracked.....	0.16	0.03
Back chipped.....	0.03	0.01
Back out.....	0.08	0.03
Upper lug off.....	0.49	0.22
Lower lug off.....	0.12	0.07
Both lugs off.....	0.10	0.05
Head off at neck.....	0.18	0.10
Barrel off at shoulder.....	0.21	0.09
Draft bolt pulled through.....	0.12	0.01
Miscellaneous.....	0.08	0.03
Total.....	6.94	1.22

Following the presentation of these figures of actual work came a somewhat long discussion on the comparative advantages of malleable iron and steel as materials for couplers and of the value of shop tests. As was to be expected, there were strong advocates of both metals. Most of the testimony, however, was in the nature of opinions and very few figures were given comparing couplers of the two materials in actual use. In regard to shop tests, the general concensus of opinion seemed to be that while the shop tests usually practiced did not by any means furnish the conditions found in actual service, still they were valuable in showing weaknesses in design and construction.

[illegible] THE RAILWAY

readily convertible into good material. (4) Methods of handling the second-hand material should be carefully worked out and the cost carefully scrutinized, or rejuvenating material will become a matter of sentiment rather than one of profit.

For the proper assorting of material a series of suitable bins should be provided, varying in capacity to meet requirements. In handling bolts, for example, a bin is required in which all bolts are deposited as unloaded. The crooked bolts are taken to the blacksmith shop to be straightened, and they and all straight bolts are then taken to the storage bins. These bins are divided into compartments, so that all old bolts of the same diameter, and which will make good bolts of equal lengths, are placed in one bin. These compartments are all labeled. For example, there is a row of compartments carrying bolts 1 in. in diameter. The first one is labeled 1 × 15 ins., which is the length of the longest bolt in general use. The next is labeled 1 × 14 ins.and so on down to the shortest bolt in use. All bolts which by trimming and recutting can be converted into a good bolt 10 ins. long and no longer, are placed in the compartment labeled 1 × 10 ins. The bolt itself may be longer than 10 ins., but the necessary trimming will bring it to that length.

The bolt bins are located convenient to the shop in which the machinery for cutting round iron and threading bolts is located. When the shop receives an order for, say, 100 bolts 1 × 10 ins., a hundred bolts are taken from these compartments labeled 1 × 10 ins. These bolts are taken to the shears, and, if any are longer than 10 ins., the surplus metal is sheared off. They are pointed and threaded, and are then in shape to be shipped. It should be observed that in handling bolts in this way the expense of heating and heading is avoided, and this expense nearly, if not quite, offsets the cost of handling and straightening the old bolts, so that the difference between the cost of bolts obtained in this way, and bolts made from new material, is just about the difference between the cost of new round iron and scrap.

Since this process was inaugurated by the C., M. & St. P. Co. but a small quantity of round iron has been purchased. The amount purchased from Jan. 1, 1894, to Nov. 15, 1894, is 154 tons. The purchases are confined almost entirely to iron ¾ and ⅞ in. in diameter, the supply of old bolts of these diameters being insufficient to meet requirements. In looking over the scrap pile a large quantity of round iron varying in diameter from 1⅛ to 1½ ins. is found, which, if rolled down to 1 in. and ⅞-in. diameters, would more than meet the deficiency referred to above. It is proposed to erect a set of small rolls for the purpose of bringing these odd sizes of iron to the requisite diameter. With this arrangement, it is the opinion of the writer that the necessity for the purchase of any new iron for the purpose of making bolts will be entirely obviated.

It will be found in sorting over bolts and cutting them to the desired lengths, that there is a large accumulation of stub ends which are too short to be of value in making bolts. All the stub ends ¾ in. in diameter and 5½ ins. long answer perfectly for the manufacture of track bolts. One of the bolt-heading machines has been equipped with dies suitable for forming the head of track bolts, and in this way a large quantity of track bolts have been made out of what was otherwise strictly waste material. With the rolls above referred to, it is believed that a sufficient supply of ⅞ in. iron will be obtained to furnish all track bolts required. The above covers our process of handling scrap bolt material.

Considerable progress has been made in handling and [illegible]

ister a sharp blow with the spike maul. This is undoubtedly a time-saving and labor-saving method. As to its being a money-saving method, the facts are not so clear. A man receiving $1.50 per day can by this method remove in a day at least ten kegs of track bolts, worth about $25, and he converts this material into scrap, worth to the company $3 or $4. The economy of the process is, to say the least, doubtful.

It is quite interesting to note how wrong impressions which arise, and are fostered in the solitude of the office, are dispelled by the silent testimony of the scrap pile. When the writer first proposed closing and retapping nuts, the objection was at once raised that much difficulty would be experienced with wrenches which were now adapted to the standard size of nuts. After some discussion and reference to the list of standard sizes of nuts, it was decided that it would not be necessary to reduce the nut more than 1-32 in. for successful tapping, and that this would not interfere seriously with the operation of the standard wrenches. What was our astonishment in commencing operations to find that the nuts varied from the standard size as laid down in our tables as much as ⅛ in. in width of head, and that it was necessary to assort nuts for the same diameter of bolts into at least four piles in order to use the dies successfully in compressing them; also that the weight of a hundred nuts from the scrap pile was nearly 25% greater than that of 100 standard nuts. It is with some hesitation that the writer thus announces his superior ignorance of the practice on the road with reference to nuts. He can say, however, that the list of sizes in the office is perfectly correct to the nearest 1-64 in., and it is certainly very convenient in making drawings.

In addition to the items which can, with a little attention, be converted into useful material for the same service as that for which they were originally designed, there are large amounts of material, which, with a little shearing and straightening, can be utilized for purposes which differ from their original use. For example, crown-bar washers can always be supplied from clippings which would otherwise be waste material. Center pin plates in sufficient number to equip all new cars can be obtained from the scrap heap iron pile for the cost of shearing and straightening; and this brings up the question of the treatment of sheet iron in the scrap pile. The most effective results so far have been obtained by sorting the sheet iron coming to the scrap pile with reference to its thickness and, to a certain extent, with reference to its condition. A washer punch in connection with the scrap sheet iron pile would undoubtedly furnish all the washers required by a railroad company, for the expense of punching. This is especially true if a small set of rolls were at hand to bring the plates of varying thickness to just what may be required. Indeed, a small set of rolls seems to be one of the most useful adjuncts to a railroad blacksmith shop, and could be utilized in many ways besides those already mentioned.

Examples might be multiplied indefinitely, like those above, without adding anything of special value to this paper. The scrap pile in reality should include not only parts of machinery, but also complete machines, cars, and locomotives which are no longer fit for service. It seems to be the impression, in the case of cars and locomotives, that general rules for scrapping them can be elaborated in the office. The writer is of the opinion that such rules fall far short of accomplishing their purpose, and that only a careful and judicious inspection, as in the case of any other material going to the scrap pile, can insure the best economy.

vice, and is building 64 more; France has 217 in service, and is building 42 more; Germany has 119, and is building eight, and Italy has 178 in service, and is constructing 11.

The Philadelphia Suburban Passenger Ry. Co., leased by the Philadelphia Traction Co., has had an ordinance passed through the Select Council of Philadelphia, permitting it to build a network of lines in the upper part of the city. The final vote was 25 to 10, but the opposition was vigorous on the charge that the city received absolutely nothing for the use of 10 miles of dedicated and 91 miles of yet unopened streets, out of the total 107 miles, constituting the proposed system. The franchise has still to pass the Common Councils and receive the Mayor's approval to be valid.

The construction of a loop terminal to connect the various elevated railway lines entering the business district of Chicago has been taken up by the elevated railway companies of that city in a manner which, if the newspapers are to be believed, at last promises some tangible results. On Nov. 22 the Union Elevated Ry. Co. was incorporated, with a capital stock of $5,000,000, by capitalists connected with the syndicate which controls the Northwestern and Lake St. elevated railway companies and the majority of surface street railways on the North and West sides of the city. This company proposes to construct the loop line terminal mentioned. According to the present plans the line will begin at Harrison St., and will run north on Wabash Ave. to Lake St., west on Lake St. to Market St., south on Market St. to Van Buren St., east on Van Buren St. to Fifth Ave., and thence south to Harrison St. and east to the starting point. It is stated, however, that a change of route may be made, which will take the line south on Clark St., from Van Buren St. to Harrison St., instead of on Fifth Ave., giving up Fifth Ave. in favor of the more populous Clark St. Four elevated lines will connect with this terminal loop, viz.: The Metropolitan West Side Elevated Ry., the Northwestern Elevated Ry., the Lake St. Elevated Ry. and the Chicago & South Side Rapid Transit Ry. These various lines will connect with the loop at Van Buren and Market streets, Fifth Ave. and Lake St., Market and Lake streets, and Harrison St. and Wabash Ave., respectively. In connection with this loop-line scheme is published the statement that the Lake St. Elevated Ry. will be changed to operate by electric power, and that the Northwestern elevated will be built as an electric line. These statements go so far as to say that the contracts have already been let for changing the Lake St. line from steam to electricity. If the newspaper "interviews" with the people in the interest of these schemes are to be believed, the proposed loop line is only the matter of a few months' work, but in view of the present financial standing of the elevated railway companies concerned, and the multitude of loop-line schemes which have already been planned and abandoned, some doubt may reasonably be felt as to the certainty of its immediate construction. It may also be noted in this connection that no application has as yet been made to the city authorities for a franchise permitting the construction of the terminal.

CONSTRUCTION NEWS.

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win is reported as securing the right of way through Johnstown, Pa., for an extension to the coal fields of Somerset county.

Projects and Surveys.

LAKE ERIE & INDIANA.—A correspondent writes us as follows: An effort is now being made to finance the Lake Erie & Indiana Ry. enterprise, a project organized in 1892 to build a line of standard gage steam railway from Whitehouse, on the line of the Wabash, near Toledo, O., westerly to Montpelier, O., a distance of 42 miles. If built and operated in connection with the Wabash this line would provide a new through air-line between Toledo and Chicago, much shorter and of easier grades than any existing route. No heavy work of any kind would be required in construction. Edgar H. Brennan, Toledo, is the chief engineer.

WOODBURY & HARDWICK.—Incorporated in Vermont, with a capital stock of $50,000, to build a railway between the towns named, a distance of 4½ miles Several valuable granite quarries are along the proposed route. The incorporators include L. D. Hazen, H. N. Turner and E. H. Blossom, of St. Johnsbury, Vt.; H. H. Powers, Geo. M. Powers, and Gov. Hendee, of Morrisville, Vt.; and C. A. Watson, of Woodbury, Vt.

Southern—Existing Roads.

DARIEN & WESTERN.—It is reported probable that this railway, now under construction, will be completed in about three months. Gen. Man., F. M. Baker, Darien, Ga.

GEORGIA MIDLAND & GULF.—Special despatches to the Atlanta "Constitution," state that this railway will be extended from McDonough to Atlanta, and will become a part of a new trunk line from Atlanta, Ga., to Jacksonville, Fla. Gen. Man., C. W. Chears, Columbus, Ga.

MOSS POINT & PASCAGOULA.—A press report from Scranton, Miss., states that the first carload of steel rails for the Moss Point & Pascagoula R. R. arrived Nov. 27, and the work of tracklaying began immediately. Captain Howze says that he expects to have the road open for traffic in a few weeks.

WEST VIRGINIA CENTRAL & PITTSBURG.—An official of this company is reported as stating that engineers are now going over the route already surveyed from Cumberland to Hagerstown, for the purpose of reducing grades, straightening curves, and making other changes wherever possible to reduce the hauling resistance. When this work is completed, everything will be ready for contractors to examine the route preparatory to making bids for construction.

Projects and Surveys.

SAVANNAH R. R. & TERMINAL.—J. W. McAlpin and Pope Barrow, Savannah, Ga., are reported as interested in this company, which proposes to secure a charter to build a line from the junction of the Charleston & Savannah and Florida Central & Peninsular roads to a point on the harbor a distance of three miles; capital stock, $500,000.

SOUTH CAROLINA.—Press reports from Charleston, S. C., state that August Belmont, J. D. Probst and M. H. Smith, of the Louisville & Nashville system, and others, have petitioned for a franchise for the South Carolina R. R. Co., to build a railway between Charleston and Augusta, about 100 miles in length.

WOODEN TRAMROAD.—J. C. Burleigh, Avon Park, Fla., will build 10 miles of wooden tramroad for use of Shay locomotives and cars. The line may be extended further in a few months.

Northwest—Existing Roads.

CHICAGO & NORTHWESTERN.—Press reports from Antigo, Wis., state that surveys are being made for an extension of the branch to Malcom, 12 miles east of Antigo, eastward to Wolf River, and that the proposed construction will probably require two short tunnels.

CHICAGO, PADUCAH & MEMPHIS.—F. P. Read, Ch. Engr., states that work with the Roberts steam tracklayer is now in progress between St. Elmo and Mount Vernon, Ill., and is expected to be completed on or about Jan. 10.

RICE LAKE, DALLAS & MENOMINEE.—It is reported probable that this railway will be extended in the spring to a connection with the Wisconsin Central at Wheeler, and to Menomonee, Wis., on the Chicago, Milwaukee & St. Paul. The road is now in operation from Rice Lake to Cameron, Wis., 17½ miles, and surveys have been made south to Dallas, [illegible]

road during the first ten months of 1894. The following is a partial summary of the figures:

	No. couplers applied.	No. couplers removed.	P. c. couplers removed.	No. br'k'ges of guard arm.
Janney, malleable iron...	14,584	902	6.18	671
California, steel.....	2,564	12	0.47	1
Gould, malleable iron....	1,182	40	.38	8
Chicago, steel.....	182	15	8.24	9
Columbia, malleable iron.	472	23	4.87	14
Mather, " "	200	6	3	...
Drexel, steel.....	180	2	1.12	None

We also have five miscellaneous couplers removed from C., M. & St. P. cars during the same period, which miscellaneous couplers were doubtless put in place of other couplers and represent some broken couplers of the other kind. In the case of knuckles broken and removed, we have of the Janney, 8.08%; California, 2.83%; Chicago, 14.83%; Columbia, 1.48%; Mather, 15%; and Drexel, 5.06%; and miscellaneous, 20 knuckles. The principal breakage in the knuckle is the pin hole of the upper lug, 455 out of a total of 1,377. The next important breakage is broken upper lug, 359 out of a total of 1,377. To the best of my knowledge and belief, the information here given is fairly correct.

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We are not indifferent to laboratory tests; far from it; few houses have made free use of them than we; but there are, as we have found, better implements and means for investigation than the drop and the 200,000 lbs. testing machine, at least we think so, when the subject of investigation is a coupler. A tabulated statement of breakages showing 31 different classes of fracture in coupler and knuckle, might interest, but I prefer to-day to give the effect of these breakages in a different form, one which can be more readily carried in the memory. The actual cost of maintenance is all that need interest you materially in discussing the economies of the question, and so far as the Janney coupler is concerned, we are able to give you that in the most exact form. For the equipment alluded to (equal to 170,395 cars) the actual cost has been 83.2 cts. per car per year. We have in service included in the above, 106,000 couplers (53,000 cars), which have now an average of one full year's service at a cost of 37.39 cts. per car per year. The shank failures of these couplers according to the same tabulation is one breakage for every 526 couplers in service one year. This we consider a favorable showing, but while the number is large enough to give a respectable average, the term of service is not sufficiently extended to warrant a full acceptance of these figures as conclusive. In this matter we deal exclusively with known facts. We know that there are just that many couplers in service, and we know the exact sum which we have received for repairs. In equating the time we have allowed one month from the time the coupler leaves our works for it to get upon a car. It will be observed that from our standpoint the calculation is a very simple one. We are not in the position of the car owner, who must guess how many of his cars are off his own line and how many foreign cars he has in exchange; everything concentrates with us as in a clearing house; and the regularity of the current figures from month to month and year to year gives us the same confidence in them as attends insurance tables. While I do not agree with Mr. Waitt as to the necessity for an increase in width of the shank to 5½ ins., I am bound to say that some of the reports which he has laid before you would indicate a necessity for some remedy in many cases.

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UTILIZATION OF THE RAILWAY SCRAP PILE.

At the meeting of the Western Railway Club held in Chicago, Nov. 20, Mr. J. N. Barr, Superintendent of Motive Power, Chicago, Milwaukee & St. Paul Ry., read a very interesting and suggestive paper on the best disposal and use of the material in the railway scrap pile. After referring briefly to the information to be gained from the study of the worn-out material in the scrap pile, Mr. Barr continued:

The definite question is, How shall the scrap pile be handled to make its information most available, and to utilize such material as may be made serviceable with a small expenditure of money? (1) All material unfit for further use should be shipped to one central point, which should be located at the main shops. (2) While it is not necessary to assort this material as carefully as the new material in the storehouse is assorted, there should be a better assortment than the one usually prevalent of wrought scrap Nos. 1 and 2, busheling scrap, etc. (3) Special attention should be given while unloading to sorting out good material and what is readily convertible into good material. (4) Methods of handling the second-hand material should be carefully worked out and the cost carefully scrutinized, or rejuvenating material will become a matter of sentiment rather than one of profit.

For the proper assorting of material a series of suitable bins should be provided, varying in capacity to meet requirements. In handling bolts, for example, a bin is required in which all bolts are deposited as unloaded. The crooked bolts are taken to the blacksmith shop to be straightened, and they and all straight bolts are then taken to the storage bins. These bins are divided into compartments, so that all old bolts of the same diameter, and which will make good bolts of equal lengths, are placed in one bin. These compartments are all labeled. For example, there is a row of compartments carrying bolts 1 in. in diameter. The first one is labeled 1 × 15 ins., which is the length of the longest bolt in general use. The next is labeled 1 × 14 ins.and so on down to the shortest bolt in use. All bolts which by trimming and recutting can be converted into a good bolt 10 ins. long and no longer, are placed in the compartment labeled 1 × 10 ins. The bolt itself may be longer than 10 ins., but the necessary trimming will bring it to that length.

The bolt bins are located convenient to the shop in which the machinery for cutting round iron and threading bolts is located. When the shop receives an order for, say, 100 bolts 1 × 10 ins., a hundred bolts are taken from these compartments labeled 1 × 10 ins. These bolts are taken to the shears, and, if any are longer than 10 ins., the surplus metal is sheared off. They are pointed and threaded, and are then in shape to be shipped. It should be observed that in handling bolts in this way the expense of heating and heading is avoided, and this expense nearly, if not quite, offsets the cost of handling and straightening the old bolts, so that the difference between the cost of bolts obtained in this way, and bolts made from new material, is just about the difference between the cost of new round iron and scrap.

Since this process was inaugurated by the C., M. & St. P. Co. but a small quantity of round iron has been purchased. The amount purchased from Jan. 1, 1894, to Nov. 15, 1894, is 154 tons. The purchases are confined almost entirely to iron ⅝ and ⅞ in. in diameter, the supply of old bolts of these diameters being insufficient to meet requirements. In looking over the scrap pile a large quantity of round iron varying in diameter from 1⅛ to 1½ ins. is found, which, if rolled down to 1 in. and ⅞-in. diameters, would more than meet the deficiency referred to above. It is proposed to erect a set of small rolls for the purpose of bringing these odd sizes of iron to the requisite diameter. With this arrangement, it is the opinion of the writer that the necessity for the purchase of any new iron for the purpose of making bolts will be entirely obviated.

It will be found in sorting over bolts and cutting them to the desired lengths, that there is a large accumulation of stub ends which are too short to be of value in making bolts. All the stub ends ¾ in. in diameter and 5½ ins. long answer perfectly for the manufacture of track bolts. One of the bolt-heading machines has been equipped with dies suitable for forming the head of track bolts, and in this way a large quantity of track bolts have been made out of what was otherwise strictly waste material. With the rolls above referred to, it is believed that a sufficient supply of ¾-in. iron will be obtained to furnish all track bolts required. The above covers our process of handling scrap bolt material.

Considerable progress has been made in handling and utilizing second-hand nuts, which, on account of injury to the thread, or worn thread, are unfit for further service. The nuts are collected and assorted very much the same as bolts. One of the bolt-heading machines has been fitted up with dies suitable for compressing the nuts slightly. A compression sideways of about 1-32 in. is sufficient to close the nuts so that, in retapping, a nut with a practically full and perfect thread is obtained. It has been found desirable to pickle the nuts in a weak solution of hydrochloric acid, in order to remove rust, and thus prevent undue wear of the taps. With our present arrangements, the results obtained from handling the second-hand nuts is not as satisfactory as in the case with bolts. There is no question, however, but that a large supply of nuts can be obtained in this way at a materially lower price than what we would have to pay for new material.

In following up the assorting of nuts, one bin was selected for the reception of track nuts. As these began to accumulate, it was noted with some surprise on the part of the writer that nearly all the nuts had stub ends of bolts in them. The first impression produced was that the wrenches used by the trackmen were long handled, or the trackmen were unusually robust. A closer inspection, however, revealed the fact that each nut showed decided indentations on the outside. They told the story completely. The trackmen were ingenious, and found that the most expeditious method of removing the bolts was to admin-

ister a sharp blow with the spike maul. This is undoubtedly a time-saving and labor-saving method. As to its being a money-saving method, the facts are not so clear. A man receiving $1.50 per day can by this method remove in a day at least ten kegs of track bolts, worth about $25, and he converts this material into scrap, worth to the company $3 or $4. The economy of the process is, to say the least, doubtful.

It is quite interesting to note how wrong impressions which arise, and are fostered in the solitude of the office, are dispelled by the silent testimony of the scrap pile. When the writer first proposed closing and retapping nuts, the objection was at once raised that much difficulty would be experienced with wrenches which were now adapted to the standard size of nuts. After some discussion and reference to the list of standard sizes of nuts, it was decided that it would not be necessary to reduce the nut more than 1-32 in. for successful tapping, and that this would not interfere seriously with the operation of the standard wrenches. What was our astonishment in commencing operations to find that the nuts varied from the standard size as laid down in our tables as much as ⅛ in. in width of head, and that it was necessary to assort nuts for the same diameter of bolts into at least four piles in order to use the dies successfully in compressing them; also that the weight of a hundred nuts from the scrap pile was nearly 25% greater than that of 100 standard nuts. It is with some hesitation that the writer thus announces his superior ignorance of the practice on the road with reference to nuts. He can say, however, that the list of sizes in the office is perfectly correct to the nearest 1-64 in., and it is certainly very convenient in making drawings.

In addition to the items which can, with a little attention, be converted into useful material for the same service as that for which they were originally designed, there are large amounts of material, which, with a little shearing and straightening, can be utilized for purposes which differ from their original use. For example, crown-bar washers can always be supplied from clippings which would otherwise be waste material. Center pin plates in sufficient number to equip all new cars can be obtained from the scrap heap iron pile for the cost of shearing and straightening; and this brings up the question of the treatment of sheet iron in the scrap pile. The most effective results so far have been obtained by sorting the sheet iron coming to the scrap pile with reference to its thickness and, to a certain extent, with reference to its condition. A washer punch in connection with the scrap sheet iron pile would undoubtedly furnish all the washers required by a railroad company, for the expense of punching. This is especially true if a small set of rolls were at hand to bring the plates of varying thickness to just what may be required. Indeed, a small set of rolls seems to be one of the most useful adjuncts to a railroad blacksmith shop, and could be utilized in many ways besides those already mentioned.

Examples might be multiplied indefinitely, like those above, without adding anything of special value to this paper. The scrap pile in reality should include not only parts of machinery, but also complete machines, cars, and locomotives which are no longer fit for service. It seems to be the impression, in the case of cars and locomotives, that general rules for scrapping them can be elaborated in the office. The writer is of the opinion that such rules fall far short of accomplishing their purpose, and that only a careful and judicious inspection, as in the case of any other material going to the scrap pile, can insure the best economy.

The completion of the Jeddo mine drainage tunnel, in Luzerne Co., Pa., is arrested by an injunction brought by some farmers of the Schuylkill valley. The tunnel is about five miles long, cost about $2,500,000, and is practically completed. It was bored to drain the Harleigh and Ebervale coal mines, with numerous adjoining workings, and by draining these flooded mines, will insure an output of millions of tons of coal, and restore prosperity to a dozen mining towns now dead. The complainants own fine farms along the banks of Butler Creek, into which the mines would drain, and from which they obtain their water supply. They claim that the discharge of sulphur water and mine refuse into this creek would practically destroy their farms, and hence demand stoppage of the tunnel work or proper compensation for damages. The company is making a stubborn fight.

Secretary of the Navy Herbert recommends in his annual report the building of three new battleships, at $4,000,000 each, and 12 torpedo boats, at a cost not exceeding $107,000 each. He advocates the substituting of some other material than wood in the fittings of our warships, as the recent Chinese-Japanese naval battles have demonstrated the fact that wood splinters played sad havoc among the crews in these battles. The lack of torpedo-boats in our service is painfully evident, says Mr. Herbert. The United States now has three in service, with three more ordered; England has 175 in service, and is building 64 more; France has 217 in service, and is building 42 more; Germany has 119, and is building eight, and Italy has 178 in service, and is constructing 11.

The Philadelphia Suburban Passenger Ry. Co., leased by the Philadelphia Traction Co., has had an ordinance passed through the Select Council of Philadelphia, permitting it to build a network of lines in the upper part of the city. The final vote was 23 to 10, but the opposition was vigorous on the charge that the city received absolutely nothing for the use of 10 miles of dedicated and 91 miles of yet unopened streets, out of the total 107 miles, constituting the proposed system. The franchise has still to pass the Common Councils and receive the Mayor's approval to be valid.

The construction of a loop terminal to connect the various elevated railway lines entering the business district of Chicago has been taken up by the elevated railway companies of that city in a manner which, if the newspapers are to be believed, at last promises some tangible results. On Nov. 22 the Union Elevated Ry. Co. was incorporated, with a capital stock of $5,000,000, by capitalists connected with the syndicate which controls the Northwestern and Lake St. elevated railway companies and the majority of surface street railways on the North and West sides of the city. This company proposes to construct the loop line terminal mentioned. According to the present plans the line will begin at Harrison St., and will run north on Wabash Ave. to Lake St., west on Lake St. to Market St., south on Market St. to Van Buren St., east on Van Buren St. to Fifth Ave., and thence south to Harrison St. and east to the starting point. It is stated, however, that a change of route may be made, which will take the line south on Clark St., from Van Buren St. to Harrison St., instead of on Fifth Ave., giving up Fifth Ave. in favor of the more populous Clark St. Four elevated lines will connect with this terminal loop, viz.: The Metropolitan West Side Elevated Ry., the Northwestern Elevated Ry., the Lake St. Elevated Ry. and the Chicago & South Side Rapid Transit Ry. These various lines will connect with the loop at Van Buren and Market streets, Fifth Ave. and Lake St., Market and Lake streets, and Harrison St. and Wabash Ave., respectively. In connection with this loop-line scheme is published the statement that the Lake St. Elevated Ry. will be changed to operate by electric power, and that the Northwestern elevated will be built as an electric line. These statements go so far as to say that the contracts have already been let for changing the Lake St. line from steam to electricity. If the newspaper "interviews" with the people in the interest of these schemes are to be believed, the proposed loop line is only the matter of a few months' work, but in view of the present financial standing of the elevated railway companies concerned, and the multitude of loop-line schemes which have already been planned and abandoned, some doubt may reasonably be felt as to the certainty of its immediate construction. It may also be noted in this connection that no application has as yet been made to the city authorities for a franchise permitting the construction of the terminal.

CONSTRUCTION NEWS.

RAILWAYS.

East of Chicago—Existing Roads.

NEW YORK CENTRAL & HUDSON RIVER.—This company is reported as making a survey from Malone Junction to Norwood, with a view to connecting the Rome, Watertown & Ogdensburg road with the Adirondack & St. Lawrence. The proposed new road would be about 40 miles in length and would parallel the Ogdensburg & Lake Champlain division of the Central Vermont.

NEW YORK, NEW HAVEN & HARTFORD.—The railroad commissioners of Connecticut, are considering plans for 4-tracking this road and the abolishing of five grade crossings at Norwalk, Conn. It is reported that a new 4-track drawbridge is to be constructed about 3 ft. higher than the present bridge. The railway will be elevated to a grade 13 ft. above Washington St. near the present station, the street being lowered several feet. The new passenger station will be located 1,100 ft. west of the present one, with a station on each side of the tracks connected by a subway. The Danbury & Norwalk road will be elevated. The plans are generally approved, except the proposed change of location of the depot.

NEW YORK, ONTARIO & WESTERN.—E. Canfield, Ch. Engr., Middletown, N. Y., writes us that no right of way has been obtained for the proposed Ellenville branch, noted last week, but that there is no immediate prospect of beginning construction. For further information, apply at the office at 56 Beaver St., New York.

PENNSYLVANIA.—Press reports from Elkton, Md., state that the construction of the Elkton & Middletown road, noted in our issue of Nov. 22, is well under way. Tracklaying was commenced Nov. 28.——Geo. Irwin is reported as securing the right of way through Johnstown, Pa., for an extension to the coal fields of Somerset county.

Projects and Surveys.

LAKE ERIE & INDIANA.—A correspondent writes us as follows: An effort is now being made to finance the Lake Erie & Indiana Ry. enterprise, a project organized in 1892 to build a line of standard gage steam railway from Whitehouse, on the line of the Wabash, near Toledo, O., westerly to Montpelier, O., a distance of 42 miles. If built and operated in connection with the Wabash this line would provide a new through air-line between Toledo and Chicago, much shorter and of easier grades than any existing route. No heavy work of any kind would be required in construction. Edgar H. Brennan, Toledo, is the chief engineer.

WOODBURY & HARDWICK.—Incorporated in Vermont, with a capital stock of $50,000, to build a railway between the towns named, a distance of 4½ miles Several valuable granite quarries are along the proposed route. The incorporators include L. D. Hazen, H. N. Turner and E. H. Blossom, of St. Johnsbury, Vt.; H. H. Powers, Geo. M. Powers, and Gov. Hendee, of Morrisville, Vt.; and C. A. Watson, of Woodbury, Vt.

Southern—Existing Roads.

DARIEN & WESTERN.—It is reported probable that this railway, now under construction, will be completed in about three months. Gen. Man., F. M. Baker, Darien, Ga.

GEORGIA MIDLAND & GULF.—Special despatches to the Atlanta "Constitution," state that this railway will be extended from McDonough to Atlanta, and will become a part of a new trunk line from Atlanta, Ga., to Jacksonville, Fla. Gen. Man., C. W. Chears, Columbus, Ga.

MOSS POINT & PASCAGOULA.—A press report from Scranton, Miss., states that the first carload of steel rails for the Moss Point & Pascagoula R. R. arrived Nov. 27, and the work of tracklaying began immediately. Captain Howze says that he expects to have the road open for traffic in a few weeks.

WEST VIRGINIA CENTRAL & PITTSBURG.—An official of this company is reported as stating that engineers are now going over the route already surveyed from Cumberland to Hagerstown, for the purpose of reducing grades, straightening curves, and making other changes wherever possible to reduce the hauling resistance. When this work is completed, everything will be ready for contractors to examine the route preparatory to making bids for construction.

Projects and Surveys.

SAVANNAH R. R. & TERMINAL.—J. W. McAlpin and Pope Barrow, Savannah, Ga., are reported as interested in this company, which proposes to secure a charter to build a line from the junction of the Charleston & Savannah and Florida Central & Peninsular roads to a point on the harbor a distance of three miles; capital stock, $500,000.

SOUTH CAROLINA.—Press reports from Charleston, S. C., state that August Belmont, J. D. Probst and M. H. Smith, of the Louisville & Nashville system, and others, have petitioned for a franchise for the South Carolina R. R. Co., to build a railway between Charleston and Augusta, about 100 miles in length.

WOODEN TRAMROAD.—J. C. Burleigh, Avon Park, Fla., will build 10 miles of wooden tramroad for use of Shay locomotives and cars. The line may be extended further in a few months.

Northwest—Existing Roads.

CHICAGO & NORTHWESTERN.—Press reports from Antigo, Wis., state that surveys are being made for an extension of the branch to Malcom, 12 miles east of Antigo, eastward to Wolf River, and that the proposed construction will probably require two short tunnels.

CHICAGO, PADUCAH & MEMPHIS.—F. P. Read, Ch. Engr., states that work with the Roberts steam tracklayer is now in progress between St. Elmo and Mount Vernon, Ill., and is expected to be completed on or about Jan. 10.

RICE LAKE, DALLAS & MENOMINEE.—It is reported probable that this railway will be extended in the spring to a connection with the Wisconsin Central at Wheeler, and to Menominee, Wis., on the Chicago, Milwaukee & St. Paul. The road is now in operation from Rice Lake to Cameron, Wis., 7½ miles, and surveys have been made south to Dallas, 124 miles.

Projects and Surveys.

ALDEN, CLARION & WESTERN.—A press report from Eldora, Ia., states that Judge John Potter, of that city, ex-Pres. Chicago, Iowa & Dakota, is organizing a new construction company to be known as the Alden, Clarion & Western, to build a railway from Alden to Clarion and northwest to connect with some through line.

MARINETTE, TOMAHAWK & WESTERN.—Press reports from Tomahawk, Wis., state that the grading of this railway has been commenced at that city and that the rails will be laid to a connection with the Milwaukee, Lake Shore & Western within two months.

Southwest—Existing Roads.

ATCHISON, TOPEKA & SANTA FE.—The Wichita, Kan., "Eagle" states that it is probable that the gap between Mullinville and Dodge City will soon be filled in. The extension was partially graded some time ago, and it is thought that the line can be built for $50,000.——Press reports from Guthrie, Okla., state that prominent officials of this company have about decided to build an extension form Hunnewell, Kan., across Oklahoma to Purcell, Ind. T.; also that Col. Cooper, founder of the town of Seward, ten miles south of Guthrie, has organized a company to build a short line from that town southeast to the coal fields and mineral beds in Indian Territory, and that as Col. Cooper is an old-time Santa Fe employee, it is believed that this company is back of his project.

CHOCTAW, OKLAHOMA & GULF.—Geo. S. Good & Co., Lock Haven, Pa. (present address South McAlester, Ind. T.), have sublet nearly all of the 122 miles of

work between South McAlester and Oklahoma City, as noted Nov. 15, and the construction will be in progress on all parts of the line in a few days. The work is now under way. A telephone line will be erected at once between South McAlester and Oklahoma City. The sub-contracts are as follows: East of Oklahoma City—Sections 1 to 6, J. W. Powell; 7 to 12, John A. O'Keefe; 13 to 32, Ware, Maney & Co.; 33 to 42, St. Joseph Construction Co; 43 to 47, A. F. Burke; 48 to 50, T. S. McCoy; 51 to 52, Ware, Maney & Co. West from South McAlester—Sections 11 to 12, J. H. Barrett; 13 to 14, Conelly & Doyle; 15 to 16, W.H. Corner; 17 to 19, Dowling & McGunnigle; 20 to 21, J. E. Collins; 22, Ward & Elliott; 23, Wm. O'Connor; 24 to 25, Ferguson Contracting Co.; 26, Pat Rail; 27, James Crowley; 30 to 31, J. H. Howard; 32 to 35, Coffin Sherman; 36 to 40, A. J. Tanger & Co.; 41 to 43, A. W. Scott; 44 to 53, Ferguson Contracting Co.

CORSICANA & SOUTHEASTERN.—Col. C. W. Coykendall, Corsicana, Tex., has resigned as president and is now vice-president and general manager of this company. C. B. Kountze, Denver, has been elected president, and as Mr. Kountze is reported as interested in real estate at Sabine Pass, his interest in the road now under construction is taken as an assurance that the entire 350 miles will be built as soon as possible. The work was noted in our issue of Nov. 8.

GALVESTON & WESTERN.—It is reported that this railway will be extended to Houston, Tex. The extension would be 25 miles long.

GULF & INTERSTATE.—The grading of this road is expected to be completed to Beaumont, Tex., next week. The grading on the main line from Bolivar Point to the junction south of Sour Lake, where connection with the Beaumont branch is made, was completed last week.

INTERNATIONAL & GREAT NORTHERN.—A press report from Georgetown, Tex., states that the Georgetown branch of this road will soon be extended about 75 miles to iron fields in Llano county.

PECOS VALLEY.—J. J. Hagerman, Pres., Colorado Springs, Colo., is reported to have recently traveled overland from Roswell, N. Mex., to Amarillo, Tex., with a view to extending this railway to Amarillo. Such a road would give the Santa Fe a more direct route from Chicago and Kansas City to El Paso and the city of Mexico.

ST. LOUIS & SOUTHWESTERN.—Officials of this company are reported as in favor of building an extension to Dallas, Tex., if the city will give the railway proper terminal facilities.

TEXARKANA & FORT SMITH.—Tracklaying on this railway has been resumed and steel rails are now laid to a point near the town of Winthrop, Ark., and are expected to reach Little River in about two weeks. Contracts have been let for the construction of the bridge at Morris ferry and the road to Fort Smith will be pushed to completion.

Projects and Surveys.

CHICKASAW & CHOCTAW NATIONAL.—Press reports state that surveyors have been in the field for several weeks making surveys for this proposed road, which is projected to run from Fort Smith, Ark., through the Choctaw Nation to Denison, Tex. The company has purchased the charter and rights of the Denison & Northern Ry. Newton B. Childs, of Kansas City, Mo., is general manager, and O. H. Brown is superintendent of construction.

EL PASO, MEXICAN & CHICAGO.—The city council of El Paso, Tex., has granted a right of way and franchise for this railway within the city limits. J. L. Bell, of El Paso, secured the franchise in his name as trustee for his Eastern associates. Press reports state that the new road will be run from El Paso to White Oaks, N. Mex., thence north to Liberal, Kan., where it will connect with the Chicago, Rock Island & Pacific, shortening the distance from St. Louis and Chicago to El Paso 260 miles less than any existing line. The franchise provides that 100 miles of the road must be built and in operation by Dec. 1, 1897. Mr. Bell has 160 miles of the road already surveyed, according to reports.

FORT SMITH, PARIS & DARDANELLE.—It is reported that the construction of this railway has been commenced, and that the line is to be connected with the Choctaw, Oklahoma & Gulf road, now being built. The Fort Smith line will extend eastwardly about 80 miles. Messrs. Stevenson or Patterson, Fort Smith, Ark., may be addressed. T. Hurley is contractor for part of the work.

KANSAS CITY, OKLAHOMA & SOUTHWESTERN.—Press reports state that arrangements have been completed for floating the bonds of this company and that steps will be taken as soon as possible to place the line under construction. The route is from Coffeyville, Kan., southwest through Pawhuska, Pawnee, Stillwater, Guthrie, El Reno and Fort Sill, Okla., to Vernon, Tex. A correspondent wrote us last month that Robert Martin, Pres., East Liverpool, O., was in England negotiating the bonds.

LITTLE ROCK & PACIFIC.—Incorporated in Arkansas to build a railway from Little Rock to Wister Junction, Ind. T., 100 miles, to connect at the latter place with the St. Louis & San Francisco, with 70 miles of branches; capital stock, $4,000,000, of which $230,000 has been subscribed; Pres., Gov. W. M. Fishback; Vice-Pres., D. J. Jones; Secy., Geo. M. Clark, Atty., S. T. Cockrell; directors: J. H. McCarthy, W. R. Worthen, C. N. Knight, H. B. Armistead, C. N. Rix, Hot Springs; A. Lloyd, Russellville.

OKLAHOMA CENTRAL.—Press reports from Perry, Okla., state that L. F. Hoops, of Parker, Okla., one of the incorporators, was before Judge Bierer in district court Nov. 28 to get a commissioner appointed to condemn right of way through Kay county for this railway. The road starts at Hunnewell, Kan., and will run by way of Perry, Stillwater and Parker to some place on the Gulf of Mexico. The survey from Hunnewell to Parker has already been made, and grading will begin within the next 30 days. A commissioner has been appointed to condemn right of way through several counties. Pres., C. G. Jones, Oklahoma City, Okla.

PERLA, PRINCETON & SOUTHERN.—M. A. Nulsen, Malvern, Ark., one of the incorporators, writes us that the capital is all secured for building this railway, as noted in our issue of Nov. 8, and that the construction will begin next spring. The route is from Perla, through Hamlen, Tulip, Princeton and Eagle Mills, Ark., 51 miles. Surveys will be commenced this week. Pres., Adelbert Strauss, St. Louis.

POMONA, SILOAM & SOUTHERN.—The incorporation of this company was noted in our issue of Nov. 8 to build a railway 10 miles long, from Pomona to Siloam Springs. John T. Pressly, Siloam Springs, Mo., one of the incorporators, writes us that the principal part of the capital has been secured and that contracts for the construction will be awarded in about 60 days. Pres., H. D. Mackey.

RIO GRANDE NORTHERN.—G. L. Marshall, Ch. Engr., El Paso, Tex., is reported as stating that the contracts for building this railway have all been signed and that the construction will be commenced this month. The road will be about 26 miles in length and will be extended from Chispa, Tex., on the Southern Pacific, to the San Carlos coal fields, on the banks of the Rio Grande.

ST. LOUIS AVOYELLES & SOUTHWESTERN.—The construction of this railway was commenced at Bunkie, La., Nov. 28, and is expected to be completed in about four months. The road will be 42 miles in length and was noted in our issue of Nov. 22. Ch. Engr., Ira W. Sylvester, Alexandria, La.

TEXAS.—Bids are asked by J. H. Lynch, Union Trust Bldg., St. Louis, Mo., for all classes of materials for constructing 20 miles of railway in this state.

WINTHROP & ROCKY COMFORT.—Incorporated in Arkansas to build a railway from Winthrop station on the Texarkana & Fort Smith, southwesterly through Little Rock county to the Indian Territory boundary line west of Rocky Comfort, a distance of 15 miles; capital stock, $150,000; directors, Fred B. Hubbell (Secy. and Treas., Texarkana & Fort Smith Ry.), W. A. Williams, W.C. Merriam, Texarkana, Ark.; J. T. Noithenius, Kansas City, Mo.; N. A. George, Rocky Comfort, Ark.

Rocky Mt. and Pacific—Existing Roads.

BURRARD INLET & FRASER VALLEY.—C. D. Rand, Pres., Vancouver, B. C., writes us that the capital for building this railway has been secured subject to conditions which will probably be accepted and that the contracts will be let at once. Surveys are completed, right of way practically secured, and 14 miles cleared and ready for grading. The route is from Sumas, Wash., by way of New Westminster to Vancouver, B. C., 51½ miles. Ch. Engr., J. T. Barlow.

COLUMBIA & PUGET SOUND.—Press reports state that a party of engineers under A. A. Booth is in the field revising the line for the extension of this road to a connection with the Northern Pacific, near Palmer, which is known as the Palmer cut-off, and it is understood that the construction of the road will soon begin and be very soon followed by the widening of the entire line to standard gage. It is stated that the roadbed and bridges were built originally for standard gage. Gen. Man., C. J. Smith, Seattle, Wash.

COOS BAY, ROSEBURG & EASTERN.—J. B. Hassett, Secy., Marshfield, Ore., writes us that this railway is in operation from Marshfield to Myrtle Point, 30 miles, and that the construction force is at work beyond Myrtle Point. Surveys have been completed through to Roseburg and the contract for the construction awarded to R. A. Graham. A 2-mile spur to Beaver Hill coal mines was built from the main line 10 miles from Marshfield last summer, and coal is now being mined and shipped to Coos Bay and San Francisco. The road will be 100 miles in length. Ch. Engr., S. Z. Earle, Marshfield, Ore.

MONTEREY & FRESNO.—P. P. Danbridge, Ch. Engr., Monterey, Cal., writes as follows concerning this railway, which is under construction from Monterey by way of Salinas, San Juan, Hollister, Firebaugh and Madera to Fresno, 170 miles: Preliminary surveys have been made over the whole region traversed by this road, and a greater part of the permanent location completed. The right of way over the entire line of 170 miles and a bonus of $1,000 per mile for that distance has been donated to the railway company. It is understood that capital sufficient for the construction of the entire line from Monterey to Fresno has been provided for. Some 46 miles from Monterey Bay eastward to Hollister has been put under contract to McLean & Earles, Seattle, Wash., and the work of construction has been prosecuted on that division since July 4, 1894. It is anticipated that as soon as some preliminary matters are arranged the work of construction from Hollister eastward through the Coast Range Mountains will be inaugurated.

SANTA FE, PRESCOTT & PHOENIX.—A correspondent writes that about 160 miles of grading have been finished and 140 miles of track laid on this road, and that efforts are being made to complete the entire 200 miles to Phoenix by Feb. 1. The contractors have as large a force as possible at work. The road extends from Ash Fork, on the Atlantic & Pacific, south through Prescott and Phoenix, all in Arizona.

WHITE & COLUMBIA RIVER.—C. W. Joynt, Pres., Buckley, Wash., writes us that 3 miles of this road is in operation as a logging railway and that 16 miles have been located and right of way secured. It is the intention to reorganize in the spring with a view to building to Seattle and to the Columbia River, a distance of 175 miles.

Projects and Surveys.

AMADOR.—Incorporated in California Nov. 22, with a capital stock of $100,000; principal place of business, Amador City, Cal.; Pres., S. H. Emmons; Secy., and Treas., Newton H. Emmons; L. G. Haskin, W. F. Keeney, O. E. Martin, all of Amador City, Cal.

COLUMBIA RIVER & ASTORIA.—A press report from Astoria, Ore., Dec. 2, states that J. B. Hammond, Missoula, Mont., has signed a contract to build a railway from that city to Goble, 60 miles. The contract gives Mr. Hammond a land subsidy, valued at over $1,000,000, and binds him to begin work by April 1, 1895, and to spend at least $50,000 per month thereafter until the work is completed, on or before Oct. 1, 1896.

MARSFIELD & PENINSULA.—Capt. S. W. Symon, Pres., Portland, Ore., writes us that this railway is projected from Marsfield through North Bend to Empire City, 10 miles, and that the right of way and franchise through Marsfield is now being secured.

Foreign.

MEXICAN CENTRAL.—Press reports from Durango, Mex., state that this company has made arrangements for the early extension of the road from Gutierrez Station, situated just north of the city of Zucctocaz, to the city of Durango. The route of the proposed road passes through the towns of Chalchihuates, Nombre de Dios, Pan Alto and others. Also that surveys are being made for a new railway across the state of Chiapas, connecting with the Tehauntepec road, but skirting the Guatemala frontier.

MEXICO.—The concession recently granted by President Diaz to Mariano Barcena, for the construction of a railroad between San Luis Potosi, Mex., and Guadalajara, has been approved by the National Congress. It is announced that the construction of the line will begin immediately. It will probably be extended from San Luis Potosi, Mex., to the port of Tampico, and will parallel the Mexican Central for a part of that distance.

STREET AND ELECTRIC RAILWAYS.

NORWAY, ME.—The Norway & Paris St. Ry. Co. has been organized, with a capital stock of $25,000, to construct an electric railway two miles in length; directors, G. L. Beal, Norway; J. F. Hill, Augusta, and H. L. Shepard, Rockport.

NASHUA, N. H.—The Nashua St. Ry. Co. has been granted permission to equip its line with electricity. Supt., H. F. Webster.

MONTPELIER, VT.—Bills have been passed incorporating the Springfield Electric R. R. Co., Hardwick & Woodbury R. R. Co., Hartford St. Ry. Co., and the Mount Mansfield Electric R. R. Co.

CHICOPEE, MASS.—The Holyoke St. Ry. Co. has been granted a franchise to extend its electric line from the Willimansett bridge to this city. Gen. Man., W. S. Loomis, Holyoke.

FALL RIVER, MASS.—The Fall River St. Ry. Co. has been formed by W. E. Turner, Frank Shove, J. E. Osborn and A. B. Sanford to construct an electric railway about three miles in length. About $50,000 has been subscribed and a franchise will be asked for at once, according to reports.

NORTHAMPTON, MASS.—Press reports state that the Northampton Electric Ry. Co. is to begin work at once on a five-mile extension to East Hampton, costing $100,000. It will require 75,000 cu. yds. of filling across the meadows, where the route leaves the highway for two miles, and by so doing runs absolutely straight and nearly level. Three iron bridges will also be required.

SOUTH FRAMINGHAM, MASS.—It is reported that the South Middlesex Electric St. Ry. Co. is to extend its line to Ashland and Hopkinton. Pres., W. B. Ferguson.

WEYMOUTH, MASS.—John Kelly, Pres., Braintree & Weymouth St. R. R. Co., writes us that right of way has been obtained, surveys made and contracts awarded for constructing the proposed electric line between Braintree, East Braintree, Weymouth and East Weymouth, a distance of four miles. Principal contractor is W. O. Chapton. About two miles of the road have now been constructed. Ch. Engr., Harry Nash, North Weymouth.

SEYMOUR, CONN.—The question of extending the Derby St. Ry. Co.'s electric line to this place is being agitated. Pres., H. H. Wood; Supt., L. W. Porter, Derby.

ISLIP, N. Y.—Archibald Martin, Gen. Man. Electrical Construction Co., New York, has petitioned the town board of Islip for a franchise for an electric railway to connect Brentwood, Bay Shore and Babylon. If the franchise is granted, a company, with a capital stock of $1,000,000, will be formed and the line be constructed next year, according to reports.

BINGHAMTON, N. Y.—The trustees of Union have granted a franchise to the Binghamton, Lestershire & Union R. R. Co. Pres., G. T. Rogers.

GENEVA, N. Y.—The Waterloo, Seneca Falls & Cayuga Lake Ry. Co. has been incorporated, with a capital stock of $150,000, to build an electric railway; incofporators, Thomas Craig, Trenton; C. E. W. Smith, New York, and M. T. Atchley, Seneca Falls.

WATKINS, N. Y.—It is reported that an electric railway connecting Watkins and Havana Glens is to be built by a local company.

NEWARK, N. J.—The freeholders have granted permission to the North Jersey St. Ry. Co. to extend its electric line.

SWEDESBORO, N. J.—Right of way has been secured for a conduit electric railway system to Woodbury, by way of the Salem and Woodbury turnpike, according to press reports.

RAHWAY, N. J.—The New York & New Jersey Traction Co. has applied for a franchise to construct its electric railway along St. George and Westfield Aves. It is proposed to connect this city with Westfield, Clark township and Elizabeth.

McKEESPORT, PA.—The Versailles Traction Co. is contemplating extending its electric railway to Boston, a distance of 3½ miles, and from Buena Vista to Industry, a distance of one mile.

PITTSBURG, PA.—The Baum St. Ry. Co. was incorporated Nov. 27, to operate from Baum St. to South Highland Ave., in city of Pittsburg; capital stock, $10,000; Pres., William Flinn.——The Highland Park St. Ry. Co. was chartered Nov. 27, to operate an electric railway from South Negley and Centre Ave. to St. Clair St.; capital stock, $25,000; Pres., William Flinn.——The Liberty Traction St. Ry. Co. was chartered Nov. 27; capital stock, $70,000; to operate a street railway beginning at 11th St. and Spring Alley, through 24th St. to Liberty Ave.; Pres., John F. Scott.

BALTIMORE, MD.—The Baltimore, Severn Park & Annapolis Electric Ry. Co. has been organized, with capital stock of $250,000, to construct a line 25 miles in length. T. C. Musgrove, Philadelphia; B. F. Simons, G. Howard White and H. Y. Bready, Baltimore, are the promoters.——The City & Suburban Ry Co. has petitioned the council for permission to extend its electric line to Clifton. Gen. Man., J. F. Heyward; Ch. Engr., F. H. Sloan.——It is reported that an arrangement is being made to push the construction of the Edmondson Ave., Catonsville & Ellicott City Electric Ry. On account of financial matters the road was not built when the company was incor-

porated, some time ago. John Hubner, Baltimore county, is interested.

CRISFIELD, MD.—The Electric Light & St. Ry. Co., of Somerset county, recently granted a franchise, will commence work early next year on the construction of its road, which will be 2½ miles in length, according to reports; capital stock, $25,000; Pres., T. S. Hodson.

WESTMINSTER, MD.—The Westminster & Union Mills Electric R. R. Co. is reported to have decided to push the construction of its road. W. B. Thomas is interested.

CARLISLE, PA.—The Greensburg, Jeanneatte & Pittsburg St. Ry. Co. has been incorporated to build an electric railway to connect the places named Pres., W. F. Sadler.

BOWLING GREEN, KY.—M. H. Crump, Ch. Engr., Bowling Green Electric Ry. Co., writes us that 1½ miles of the road, which is to be five miles in length, have been built, but that horse cars are used at present. Preliminary surveys have been made and right of way secured, but the capital for construction has not yet been obtained. Contracts will probably be awarded within 90 days.

NEW ORLEANS, LA.—The Jefferson Ave. Ry. Co. is securing right of way for its proposed electric line, about 10 miles in length. Pres., W. N. Louque.

CLEVELAND, O.—The Consolidated Street Ry. Co. has applied for a franchise to extend its line to Nottingham, a distance of about four miles. Secy., J. B. Hanna.

ELYRIA, O.—C. A. Metcalf writes us that right of way has been about secured for an electric railway between this place and Oberlin, a distance of eight miles. It is proposed to extend the line to Wellington, nine miles further. The company will probably soon be incorporated. The project was noted in our issue of Nov. 22.

HARTWELL, O.—The council has passed an ordinance establishing a street railway route through this village. It is reported that there will be competitive bidding by several electric railway companies that wish to enter the Mill Creek Valley towns by this route.

LIMA, O.—A franchise has been granted to a new electric railway company to construct a line to the Lutheran College and probably to McBeth's and Hover's Lakes and Spencerville. Directors, Col. W. P. Orr, Piqua; Gen. A. N. Rice, Columbus, and J. E. Richie.

NILES, O.—The Mahoning Valley Electric Ry. Co. has been incorporated to build a line to connect this city with Girard and Youngstown; capital stock, $150,000; incorporators, C. F. Clapp, Warren; R. G. Sykes, Niles, and A. A. Anderson, Youngstown.

PIONEER, O.—The Toledo & Pioneer Electric Ry. Co. is reported as having secured right of way in this place..

RAVENNA, O.—The Ravenna Electric St. Ry. & Power Co. has been incorporated with a capital stock of $50,000; incorporators, Geo. H. Worthington, Wm. J. Akers, G. W. Gardner, J. H. Evans and R. B. Carnahan.

WARREN, O.—The Trumbull Electric Ry. Co. is reported as having applied to the county commissioners for a franchise for an extension from Niles to Girard. William Wallace is one of the directors.

ALEXANDRIA, IND.—Press reports state that a contract has been awarded to C. E. Loss & Co., Chicago, for the construction of the Indianapolis, Alexandria, Anderson & Marion Electric Ry., the estimated cost of which is $525,000. Pres., F. M. Dice.

TERRE HAUTE, IND.—Max Joseph, Pres. Terre Haute & Brazil Electric Ry. Co., writes us that right of way has been secured for the line to connect this city with Seeleyville, Cleveland, Staunton and Brazil, a distance of 13 miles. Part of the necessary $100,000 has been subscribed by local parties, but the contract will not be awarded until the full amount is obtained.

GRAND RAPIDS, MICH.—The project to construct an electric belt line railway to connect all the railways entering this city and to carry freight only will be brought before the council in the spring, according to press reports. The council refused to grant a franchise to a company for a belt line steam railway some time ago.

MACKINAC ISLAND, MICH.—J. H. Roberts, 97 Ottawa St., Grand Rapids, writes us that a franchise has been granted to him and surveys made for an electric railway, eight miles in length, around the island. The road will only be operated during the summer. Estimated gross earnings, $38,500; fare, 25 cts.

CHICAGO, ILL.—The Interurban R. R. Co. has been incorporated to construct a street railway from Highwood Station to Fort Sheridan; capital stock, $50,000; incorporators, John W. Harrington, J. P. Dymond and E. H. Thorp.——The Chicago General St. Ry. Co. has decided to issue $10,000,000 of 6% bonds for extending its road, according to reports. Secy. and Treas., L. C. Bonney.

EAST ST. LOUIS, ILL.—The citizens of Brooklyn are discussing the question of granting a franchise either to a St. Louis syndicate or to the East St. Louis Electric St. R. R. Co. to build a line on the Brooklyn road.

DEPERE, WIS.—J. H. Elmore and Frank Van Derzee have been granted a franchise for an electric railway.

OSHKOSH, WIS.—Press reports state that J. K. Tillotson has succeeded in obtaining the consent of Chicago men, who are interested in the proposed electric railway, to the immediate construction of the road in this city without regard to the future action on the franchise now pending for building the interurban railway. The company is now being formed with a capital stock of $1,000,000, and the articles of incorporation will be filed very soon. C. E. Loss & Co., who were to have built the road for Messrs Allen and Smith, had those men secured the franchise, will be given the new contract.

WAUKESHA, WIS.—Plans and specifications are being prepared for ballasting, tracklaying and setting poles for the Waukesha Beach Electric Ry. The power plant will be put in under separate bids, and will be owned by the company. The road will be completed and put in operation about May 1, according to reports. Ch. Engr., Wm. Powrie.

MASON CITY, IA.—The construction of an electric railway is reported as being discussed.

WYMORE, NEB.—The Wymore & Blue Springs Transit Co. has been incorporated with a capital stock of $25,000; incorporators, Alex. Stewart, H. C. Van Buskirk and S. T. G. Moore.

ST. LOUIS, MO.—Bonds for $150,000 are to be sold by the Fourth St. & Arsenal St. Ry. Co. for reconstructing and equipping its line with electricity. Pres., Charles Green.

RATON, N. MEX.—The Raton Gas & Ry. Co. has been incorporated by Frederick Mitchell, A. L. Dobbs and P. H. Smith.

SAN FRANCISCO, CAL.—The Market St. Ry. Co. is reported as planning to construct an electric railway along the beach for a distance of two miles. Acting Man., M. D. Stein; Engr., G. H. Fairfield.

OSHAWA, ONT.—A franchise has been granted to E. W. Rathbun, Deseronto, for an electric railway to the harbor, estimated to cost $100,000.

OTTAWA, ONT.—The Canadian Pacific Ry. Co. and the Ottawa Electric Ry. Co. are making arrangements for an electric railway from this city to Aylmer, by way of Hintonburgn and Britannia, crossing the Ottawa River at Deschene Rapids on a bridge to cost $15,000, according to reported interviews with H. B. Spencer, Asst. Supt., C. P. Ry., and T. Ahearn, Gen. Man,, Ottawa Ry. Co.

HIGHWAYS.

ALABAMA.—It is reported that authority has been asked by Dallas county to issue $50,000 in bonds for improving the roads of the county.

MICHIGAN.—Menominee county has voted on the question of issuing $25,000 in bonds for completing its county road system.

BRIDGES.

ALBANY, N. Y.—A hearing was held last week on the proposed new bridge across the Hudson River, at Bath, which the Bath-on-the-Hudson Bridge Co. wants to erect. Col. G. L. Gillespie, U. S. A., conducted the hearing. F. D. Delehanty, Martin F. Schenck and C. F. R. Coe appeared for the bridge company. The Troy Citizens' Association opposed the project.

BUFFALO, N. Y.—Bids are asked until Dec. 11 for furnishing and placing six steel brace rods in the Elmwood Ave. stone arch bridge across Scajaquada Creek, and also for furnishing and placing riprap around the foundation of same. R. G. Parsons, Secy. Dept. Pub. Works. —— A company has been incorporated to build the proposed new Grand Island Bridge. Its capital stock is $1,500,000. George Sandrock, Philo D. Beard, Oliver Watson and others, of this city, are among the incorporators. Congressman Daniels will endeavor to have the bill authorizing the construction passed at the coming short session of Congress.

NEW YORK, N. Y.—Bids are asked by the department of public works until Dec. 12 for 6,800 cu. yds. of rock excavation and 340 cu yds. of earth excavation, for the approach to the New Macomb's dam bridge.

NATCHITOCHES, LA.—Bids are asked by the chancery clerk at Natchez, Miss., until February for building a steel bridge over the Homochitto River, according to reports.

MONTGOMERY, ALA.—It is reported that Montgomery county has been authorized to issue $300,000 in bonds for bridges and road improvements.

CINCINNATI, O.—Bids are asked by the board of administration until Dec. 24 for the superstructure of a bridge over the Miami and Erie Canal, at Liberty St. The bridge is to be 53 ft. long, with two 15-ft. roadways and two 8.75-ft. sidewalks.

BRAZIL, IND.—A bridge on the Chicago & Eastern Illinois R. R., north of this city, was destroyed by fire Nov. 27. This is the second bridge burned on this railway within a week.

CHIPPEWA FALLS, WIS.—It is reported that plans are being prepared for a steel bridge 110 ft. long across Duncan Creek.

DES MOINES, IA.—The city engineer is preparing plans for a new bridge across Four Mile Creek. The bridge will be of iron, 100 ft. long. It is probable that bids will soon be asked for the work.

WATER-WORKS.

HALLOWELL, ME.—A meeting was held in the city hall Dec. 4 to consider the question of a water supply.

LYNDONVILLE, VT.—The governor has signed a bill authorizing an expenditure of $40,000 for improving the water service. The village had a $120,000 fire about a week ago.

BRADFORD, MASS.—At a town meeting last week it was voted to purchase the franchise of the present owners and to petition for a permit to take a supply from Johnson's Pond, in Boxford. The present supply is from wells and is not satisfactory.

CAMBRIDGE, MASS.—Bids are asked until Dec. 20 for 40-in. pipe, as stated in our advertising columns. L. M. Hastings, Cy. Engr.

MENDON, MASS.—The citizens have voted, 92 to 85, to take Mendon Pond and put in works.

MONSON, MASS.—The $50,000 in water bonds have been sold to W. J. Hayes & Sons, Boston, for $52,265.

BRIMFIELD, MASS.—Newton S. Hubbard and W. S. Janes are members of a committee appointed to investigate the question of securing a water supply. About $2,800 is said to have been subscribed.

WESTFIELD, MASS.—The committee has been instructed to petition for authority to secure a supply in Granville, at an estimated cost of $100,000.

CALEDONIA, N. Y.—Engineers are reported as preparing plans for works, supply probably from springs one mile from the village.

CANASERAGA, N. Y.—The citizens are reported as quite generally in favor of works, supply to be by gravity from springs nearby.

HAMMONDSPORT, N. Y.—It is reported that O'Connor & Co., Syracuse, will commence the construction of the works this fall and lay the pipe early in the spring.

MONROE, N. Y.—Bids are asked until Dec. 13 for constructing works, as stated in our advertising columns. This item was published Nov. 22 under Morris, N. Y. by mistake. Gilbert Carpenter, Pres. Comrs.

MORRIS, N. Y.—Bids are not asked yet for the construction of works. The item in our issue of Nov. 22 should have read Monroe, N. Y. For information regarding works at this place, address J. Warren Lamb, Cooperstown, N. Y.

NEW YORK, N. Y.—W. E. Preble, F. F. Kennedy, E. S. Burnham, V. A. Lewis and E. P. Ingersoll, of this city, have incorporated, in West Virginia, the Zacatecas Mexican National Water-Works Plant, Ltd.; capital stock, $5,000,000; to construct and operate water-works and irrigation plants in Mexico.

ROCKVILLE CENTER, N.Y.—W. H. Connell, Village Clk., writes us that at the special election Nov. 26 the vote was 153 in favor and 77 against constructing works. Plans and estimates will now be secured; population, 2,500.

ROME, N. Y.—J. J. Siegrist, Utica, has been awarded the contract for the extension in Garden St.

BURLINGTON, N. J.—Bids are asked until Dec. 15 for purchase of the iron tanks used prior to the erection of the water tower, as stated in our advertising columns. Geo. A. Allison, Supt.

MILLVILLE, N. J.—At an election Dec. 4 to vote on the question of purchasing the works or of appropriating $20,000 for extensions and 40 new fire plugs, less than 1,000 votes were cast, being less than one-half the registered vote, and the election will probably be declared illegal.

CHELTENHAM, PA.—The Edge Hill Water Co. has been organized by W. S. Perot, Jr., J. S. Keen, Jr., F. M. Brooke and H. B. Hodge to put in works.

DUQUESNE, PA.—The Oliver Water Co. was incorporated Dec. 1, to put in works; capital stock, $600; Treas., Jacob Schneller, 36 Ward, Pittsburg.

EAST GREENVILLE, PA.—Horatio Sands, Pottstown, has been engaged to superintend the construction of the works.

McKEESPORT, PA.—Bids are asked until Dec. 10 for two deep well pumps. Emanuel Wolf, Secy.

MEADVILLE, PA.—W. A. Doane, Cy. Engr., writes us that negotiations are being made for the purchase of the present works. The citizens recently voted to issue $75,000 in bonds for new works, which will be built unless the present plant is purchased.

PITTSBURG, PA.—The Mifflin Water Co. was incorporated Dec. 4 to supply Mifflin township, Allegheny county, with water; capital stock, $600; Treas., Jacob Schneller, 36 Ward, Pittsburg.

POTTSVILLE, PA.—G. A. Berner, Town Clk., writes us that the present talk is newspaper agitation, and that anything definite would have to be voted upon at the spring election. The water company is reported about to reduce its rates.

WHITE MARSH, PA.—The White Marsh Water Co. has been organized by E. F. Partridge, W. S. Perot, Jr., J. H. Keen, Jr., F. M. Brooks and H. B. Hodges.

NEWPORT NEWS, VA.—The Newport News Light & Water Co. commenced on Dec. 3 laying nine miles of 12 to 8-in. pipe from this city to supply Hampton, Chesapeake City and Old Point with water.

WHEELING, W. VA.—The Suburban Light & Water Co. was incorporated Nov. 25; capital stock, $500,000; of which $500 was paid in; incorporators, August Rolf, L. F. Stifel, Anton Reymann, Paul O. Reymann and Chas. Schmidt, all of Wheeling. The county board has granted the company a franchise. A reservoir and electric plant will be erected at Elm Grove and it is reported that the plans for both have been completed, and that the contracts will soon be awarded.

CUTHBERT, GA.—Robt. L. Moye, Mayor, writes us that the water bonds have been sold at a good price and that Mabie & Sullivan, Engrs., are expected to have the plans and specifications ready this week.

QUITMAN, GA.—The work on the new water-works plant is reported as to be commenced within a few days.

BARTOW, FLA.—The Howe Pump & Engine Co., Indianapolis, Ind., is about to begin the construction of the works in this city.

SELMA, ALA.—The council is reported as about to petition for authority to issue $100,000 in bonds for works.

CARROLLTON, KY.—We are informed that G. W. Pearsall, Engr., states that the estimated cost will not exceed the $20,000 appropriated for works. Mayor O. M. Wood has already received many requests for copies of the specifications, which are being prepared. Contracts will probably be awarded early next month; supply from Ohio River; population, 2,700.

ARLINGTON HEIGHTS, O.—The contract for works has been awarded to Crane & Co., Cincinnati. The bids are published under Contract Prices.

CLEVELAND, O.—The director of public works has been authorized to advertise for bids for water pipe for 1895.

LORAIN, O.—F. C. Norcross, Supt., writes us that the city has just completed an extension of 3 miles of 6-in. pipe, 3 miles of 12-in. pipe, with 24 Crane Co.'s hydrants, and 1,700 ft. of 24-in. intake pipe and well on the shore of Lake Erie, well 10 ft. in diameter and 16 ft. deep.

PORT CLINTON, O.—J. H. Faus, Cy. Clk., writes us that plans for works are being prepared by Chas. E. De Witt, Port Clinton, and that bids will probably be asked in January for the construction; estimated cost, $35,000; supply from Lake Erie; population, 3,000; Pres. Bd., O. J. True.——The council has sold the $35,000 of 5% water bonds to Rudolph Kleybolte & Co., the other bids being as follows, all bidders agreeing to pay the accrued interest from Sept. 15 in addition to the premium: Deitz, Dennison & Prior, Cleveland, $35,179; First National Bank, Niles, O., $35,350; Seasongood & Mayer, Cincinnati, $35,701; Spitzer & Co., Toledo, $35,217; W. J. Hays & Sons, Cleveland, $35,841; Rudolph Kleybolte & Co., Cincinnati, $35,882; E. H. Rollins & Sons, Boston, Mass., $35,510; German-American Bank, Port Clinton, $35,278; Farsen, Leach & Co., Chicago, $35,613.

MADISON, IND.—Bids are asked until Dec. 10 for repairs to the pump at the works. Wm. Dunn.

DECATUR, MICH.—The council is taking steps to issue the $12,000 in 5% bonds noted Nov. 22, and it is expected that the construction of the works will soon be commenced. Frank C. Stapleton, Cy. Clk.

DETROIT, MICH.—Bids are asked until Jan. 7 for the purchase of $100,000 in 30-year 4% water bonds. L. N. Case, Supt.

FONDA, IA.—Plans and specifications for works have been prepared by Crellin & Lovell, Des Moines.

LOGAN, IA.—It is reported that preparations are being made to put in new works, the old system being wholly inadequate.

EMMETT, MICH.—E. M. Keough, Village Clk., writes us that the works are completed; population, 500.

LA CROSSE, WIS.—Bids are asked until Dec. 6 for a 10,000,000-gallon pumping engine and three boilers. J. H. Clarke, Comptroller.

WAUPUN, WIS.—R. H. Oliver, Cy. Clk., writes us that he has already received a large number of letters in regard to the $33,000 in bonds voted for works, but that no date of issue or sale has yet been fixed. Fairbanks, Morse & Co., Chicago, are preparing the plans for works.

MINNEAPOLIS, MINN.—The council has voted to accept the offer of Thos. Lowry to donate 45 acres of land for a reservoir site, and has appropriated $75,000 for preliminary work.

ST. PAUL, MINN.—The Minnesota Water-Works Co. was incorporated Nov. 27 by Ambrose Tighe, J. W. Lane, M. T. Desmond, Archibald J. McA. Stark, all of St. Paul, and Jas. M. Elder, of Brainerd; capital stock, $50,000.

NEW PAYNESVILLE, MINN.—Bids are asked until Dec. 20 for the purchase of $5,000 in water bonds. A. T. Watson, Recdr.

LEBANON, KAN.—It is reported that works will be put in if the cost does not exceed $3,000.

OMAHA, NEB.—The city engineer has testified before the investigating committee on fire protection that to secure the desired results for fire protection about nine miles of new pipe would have to be laid, at a cost of about $125,000.

HANNIBAL, MO.—The "Journal" is advocating municipal ownership of works.

RICHMOND, MO.—W. T. Shoop, Chn. Com., writes us that an ordinance is being submitted granting a franchise for works.

SALISBURY, MO.—C. C. Hammond, Cy. Atty., writes us that the contract for works, as recently advertised in Engineering News, has been awarded to Jaeger & Blanchard, Rich Hill, Mo., at $14,642. The city had 48 requests for specifications, from all parts of the United States.

FAYETTEVILLE, ARK.—The Fayetteville Water Co. has been incorporated by W. B. Rees, Chas. A. Rees, of Joplin, Mo., and Chas. W. Trott, of Fayetteville; capital stock, $50,000.

BRENHAM, TEX.—The mayor has approved an ordinance providing for an issue of $40,000 in bonds to purchase the works, as offered by the water company.

DALLAS, TEX.—Bids are asked until Dec. 20 for 15,000 ft. of 30-in. cast iron water pipe. R. W. Haven, Cy. Engr.

McKINNEY, TEX.—It is reported that a vote will soon be taken to decide the question of a tax for works.

FOREST GROVE, ORE.—H. V. Gales, Hillsboro, is reported to have offered to put in works for $14,000 in 10-year 6% bonds.

PORTLAND, ORE.—Bids are asked until Dec. 18 for the purchase of $100,000 in 5% water bonds. Frank T. Dodge, Clk. Com.

LONG BEACH, CAL.—The Alamitos Water Co. has petitioned for a franchise.

MONROVIA, CAL.—Bids are asked until Dec. 7 for constructing the new pipe line from Maple Canyon to the city reservoir, a distance of 14,000 ft. W. H. Evans, Cy. Clk.

SANTA BARBARA, CAL.—Press reports state that several plans are being considered for supplying that city and the Montecito and Carpenteria valleys with water for domestic and irrigation purposes. It is said that an English syndicate has had plans prepared for a dam, tunnel and reservoir on the mountain, estimated to cost $1,000,000, and the Santa Barbara Water Co. also has a plan for a large dam and reservoir in Mission Canyon.

SEBASTOPOL, CAL.—It is reported that works and an electric light plant will be put in next year.

IRRIGATION.

ABILENE, KAN.—It is reported that the stockholders at Hartford, Conn., of the Garden City Irrigation Co. and the Southwestern Irrigation Co. have decided to repair the two ditches, which are now in the hands build a dam have been made, and the work will soon be commenced.

KEARNEY, NEB.—An irrigation company has been organized in Center county, and steps to secure right of way are being taken so that work can be commenced in the early spring, according to reports.

LARAMIE, WYO.—A company has been formed to construct a ditch on Four Mile Creek, about 100 miles from this place, estimated to cost $400,000. H. B. Gillespie, Denver, Colo., and J. C. Davis, Rawlins, Wyo., are interested.

BOULDER, COLO.—The Six Mile Ditch & Reservoir Co. is reported as having purchased 270 acres of land about four miles north of this city. Preparations to build a dam with a capacity of 41,723,300 cu. ft. of water have been made, and the work will soon be commenced.

HOLYOKE, COLO.—The Frenchman Valley Windmill Irrigation Co. has been incorporated to test the possibilities of windmill irrigation on Frenchman Creek. A well is now being excavated, and it is thought that if this well is a success the plant will be duplicated at 100 or more points along the creek next year. C. H. Harman is interested.

NEW COMPANIES.—Fruita Land & Canal Co., Denver, Colo.; $100,000; to build a ditch in Grand River Valley; J. P. Kiefer, Benjamin Kiefer, F. H. Kiefer.

Rush Creek Irrigation Canal Co., Rush Creek Precinct, Neb.; $3,000; Wm. B. Porter, A. B. Stevenson, T. W. O. Wolfe.

SEWERS.

BELMONT, MASS.—The selectmen are considering the construction of a sewer estimated to cost $27,000; deepest cut, 26 ft.

ROCKVILLE, CONN.—T. H. McKenzie, Engr., who was engaged to make a report for a system, has recommended the construction of filter beds and 16 miles of sewers, the main sewer to be 24 ins. in diameter. The entire system is estimated to cost $123,532.

WINDSOR LOCKS, CONN.—A committee has been appointed to secure an engineer to make estimates and give advie for a system, according to press reports.

BUFFALO, N. Y.—Bids are asked until Dec. 18 for constructing 18 to 10-in. pipe sewers in three streets. R. G. Parsons, Secy. Dept. Pub. Wks.——The board of public works has been directed to advertise for bids for constructing 66 to 34-in. brick sewers in two streets and 20 to 12-in. pipe sewers in South Ogden St. M. S. Hubbell, Cy. Clk.

FULTON, N. Y.—Plans have been completed for a system, and may be seen at the law office of Piper & Rice.

UTICA, N. Y.—Bids are asked until Dec. 7 for constructing 18 and 15-in. pipe sewers in two streets. J. A. Cantwell, Cy. Clk.

EAST ORANGE, N. J.—The township committee has been considering plans for a sewer through several streets, estimated to cost $15,000. It is probable that about 2,500 ft. of the proposed sewer may not be constructed at this time, making the cost about $9,000.

NEWARK, N. J.—An ordinance has been passed for the construction of a 16 to 12-in. pipe sewer in Bloomfield and Clifton Aves. A. M. Linnett, Clk. Bd. St. and Water Comrs.

NEW BRUNSWICK, N.J.—The construction of sewers in ward 6 is being discussed.

WASHINGTON, D. C.—Bids are asked by the district commissioners until Dec. 27 for constructing a sewer in Rock Creek Valley, as stated in our advertising columns.

FORTRESS MONROE, VA.—Bids are asked until Dec. 29 for constructing a system, as stated in our advertising columns. Address Maj. Chas. E. L. B. Davis, U. S. Engr. Office, Washington.

KNOXVILLE, TENN.—The North Knoxville council is discussing an ordinance for issuing bonds for $25,000 to construct sewers and improve the streets.

HAMILTON, O.—The commissioners have recommended that contracts be awarded as follows: District No. 1, contract No. 2, Greenville Construction Co., at $12,792, and district No. 1, contract No. 3, at $7,370; district No. 1, contract, No. 4, Walker & Robinson, Troy, at $8,736, and district No. 3, contract No. 2, W. H. Louthan, at $6,886.

HARTWELL, O.—Arrangements are being made to investigate the question of constructing a system, as recommended in the mayor's annual report.

WARREN, O.—Albert E. Andrews, Cy. Clk., informs us that the following bids were received Nov. 22 for constructing about 10,000 ft. of 24 to 9-in sewer, mostly of 24 to 15-in., known as the Red Run sewer:

Campbell Bros., Cleveland, O.	$8,165
Toledo Construction Co., Toledo, O.	8,964
McKinney & Duffy, Canton, O.	8,285
McDowell & McCracken, Cleveland, O.	8,498
Con. O'Donnell, Youngstown, O.	8,853
James Connolly, Cleveland, O.	8,616
McGuigan & Fisher, Meadeville, Pa.	9,588
J. C. Spaith, Pittsburg, Pa.	9,243
John Hadley, Canton, O.	8,332
Geo. J. Vetter, Youngstown, O.	11,016
Urich, Nissley & Williams, Springfield, O.	11,933
Meenice & Cunningham, Elmwood City, Pa.	9,705
J. W. Kelley, New Brighton, Pa.	10,281
James Wildes, Akron, O.	10,143
J. C. Murray, Newark, O.	9,000
F. E. Gribben, Youngstown, O.	12,976
Robert Henderson, Youngstown, O.	12,174

CRAWFORDSVILLE, IND.—James M. Waugh, Cy. Engr., writes us that no action has been taken by the council for the proposed system and that favorable action is not probable at present.

EVANSVILLE, IND.—Sherwood & Hitch have been awarded contracts for constructing a main sewer in Division St. at 48 cts. per lin. ft.; manholes, $17 each; inlets, $23 each, and Y's, $2.50 each.

INDIANAPOLIS, IND.—The following bids have been received for constructing a sewer in five streets: D. DeRuiter (awarded contract), $1.47 per lin. ft.; A. Bruner, $1.90; H. H. Fletcher, $1.76; Sheehan Bros., $1.72; J. D. Hess, $1.68; Capitol Paving & Construction Co., $1.68; W. C. Allen & Co., $1.67; Bossert & Waterman, $1.67; Fulmer-Seibert Co., $1.62; Gansberg & Roney, $1.59; W. R. Mercer & Son, $1.58; Daniel Foley, $1.58.

ALTON, ILL.—David Ryan has been awarded the contract for extending the Piasa St. sewer, at $3,500.

FARMINGTON, ILL.—C. F. Sturtevant, 800 North Second St., St. Louis, is preparing plans for a system the contracts for which will be awarded in the spring.

KEITHSBURG, ILL.—C. F. Sturtevant, St. Louis, is preparing plans for a system.

DES MOINES, IA.—The board of public works has been directed to advertise for bids for constructing a system in the southeast part of the city, estimated to cost $3,610.

FARGO, N. DAK.—Bids are asked until Dec. 10 for constructing a pipe sewer. A. O. Rupert, Cy. Audr.

MEXICO, MO.—T. M. Gill, Cy. Clk., writes us that the proposed system is to be built by degrees out of the revenue of the city. C. D. Rodgers, Cy. Engr.

ST. LOUIS, MO.—F. J. Wade, August Gehner and others, representing the Convent of the Good Shepherd, in Bamberger Ave., have petitioned that a sewer be constructed to drain the convent grounds, estimated to cost about $20,000.

SEATTLE, WASH.—The following bids have been received for constructing a sewer in Randolph St.: Taylor Bros. (awarded contract), $3,489; G. B. Kittinger $2,740; D. O. McDonald, $3,343; J. S. Holt, $3,456; J. A. Bailey, $2,948; Jas. C. Spurr, $3,509.

GALT, ONT.—A. J. McPherson, Town Engr., writes us that Willis Chipman, Toronto, is preparing plans for a system. Part of the system will probably be put in next spring.

GRANBY, QUE.—It is reported that A. L. Husbands and A. W. Mitchell have been engaged to prepare plans and estimates for a system.

STREETS.

BROOKLYN, N. Y.—The aldermen are making arrangements for paving a portion of Snediker Ave. with granite blocks, estimated to cost $29,500.

LONG ISLAND CITY, N. Y.—The General Improvement Commission has awarded the contract for improving four streets to the Barber Asphalt Paving Co., at $33,821. J. J. O'Brien has been awarded the contract for improving Henry St. at $10,488.

CAMDEN, N. J.—The street committee has been petitioned to pave Fourth St., estimated to cost $6,000.

WASHINGTON, D. C.—Bids are asked by the commissioners until Dec. 7 for paving certain alleys with sheet asphalt, asphalt blocks or brick.——The commissioners have decided to construct cement sidewalks in four streets, estimated to cost $9,700; brick sidewalks in eight streets, estimated to cost $24,375.

SANDUSKY, O.—The following bids have been received for paving Water St. with brick:

	Hallwood block.	Mack block.
Thos. Currie, Detroit	$35,540	$33,465
Hartman & Schneider, Sandusky	34,248	32,173
Michael McKean, Sandusky	32,600	31,770
G. W. Doerzbach, Sandusky	34,667	32,592
Kinnear & Graham, Columbus	31,366	29,289
Jacobs & Stewart, Norwalk	33,744	32,744
Geo. J. Doerzbach, Sandusky	35,719	32,192
Coleman & Hallwood, Columbus, O.	33,258	....

PEORIA, ILL.—The council has adopted ordinances for paving 11 streets, and it is proposed to pave 10 other streets at an estimated cost of about $22,000.

ST. PAUL, MINN.—Bids are asked until Dec. 10 for grading portions of two streets. J. C. Mueller, Clk. Bd. Pub. Wks.

HOUSTON, TEX.—Bids are asked until Dec. 17 for paving portions of nine streets with brick, asphalt or cement, three streets with asphalt, macadam or gravel, and constructing brick sidewalks in eight streets. J. T. Browne, Mayor.

ELECTRIC LIGHT AND POWER.

HINSDALE, N. H.—There is talk of an electric light plant at this place, according to reports.

PERRY, N. Y.—It is reported that the Perry Knitting Co. will put in an electric light plant at its works.

NIAGARA FALLS, N. Y.—Press reports state that the Niagara Falls Hydraulic Power & Mfg. Co. has submitted to the council its plans for constructing one of its lines for transmitting electricity for power, heating and lighting purposes. The present route will be from a point north of Riverway, across Niagara St. to the alley between Riverway and Prospect St., to and across Falls St., along the south side of Falls to Second, across to the north side of Falls and along Fourth St. The poles are to be of cedar 45 ft. long and will be placed 100 ft. apart. There will be two circuits of two wires each.

SYRACUSE, N. Y.—Press reports state that the Solvay Process Co. has purchased a site for the purpose of securing water power at the west end of Battle Island dam, above Minetto, Oswego county, and that the company proposes to locate some portion of its business and construct an electric light plant at the Battle Island dam site.

PARKESBURGH, PA.—It is reported that the citizens have voted in favor of electric street lighting.

WASHINGTON, D. C.—Bids are asked until Dec. 20 for furnishing and putting in place complete three 16 × 15 high-speed, horizontal, center crank, single valve, automatic steam engines for dynamos for the congressional library building. Bernard R. Green, Supt. and Engr.

WHEELING, W. VA.—The county commissioners have granted a franchise to the Suburban Light & Water Co. The plant will be located at Elm Grove and contracts will be awarded as soon as possible.

KALAMAZOO, MICH.—Press reports state that the council has ended the lighting controversy by voting to buy the Kalamazoo Electric Co.'s electric apparatus and a site for $12,600, and contracting with that company to run lights, until the plant is installed, at 25 and 50 cts. per light for midnight and all-night lamps.

MACKINAC ISLAND, MICH.—J. H. Roberts, Grand Rapids, writes us that he has been granted a franchise for an electric light plant of 150 arc and 4,000 incandescent lights, to be operated only during the summer months. Estimated gross earnings, $11,000.

MONROE, MICH.—The Monroe Gas Light Co. has been awarded the contract for lighting the city with electricity. An electric light plant will be put in by the company.

WALLACEBURG, MICH.—Press reports state that Biggs & Lewis, solicitors for the Hamilton & Lake Erie Power Co., will make application at the next session of the Ontario legislature to acquire the right of way for a watercourse and raceway, from some point on Lake Erie east of Dunnville to some point on Lake Ontario or Burlington Bay, and to build an electric plant for manufacturing purposes. The fall from Lake Erie to the head of Lake Ontario is said to be 300 ft.

KEOSAUQUA, IA.—Press reports state that contracts are expected to be awarded within 90 days for the construction of a water power canal from the Des Moines River about a mile above Pittsburg and emptying into the river again just below this city. The canal will be 1½ miles in length, have a fall exceeding 32 ft., and is estimated to cost $500,000.

SIOUX CITY, IA.—B. S. Holmes is reported to have secured nearly the entire right of way for the proposed canal from the Missouri River, near Burbank, to the Big Sioux River, near Elk Point (Eng. News,

Nov. 22, p. 419), and it is stated that efforts will be made to commence the construction at an early date. —C. F. Allen is advocating a scheme for a canal from Vermillion, on the Missouri River, 28 miles above this city, to this city, which it is thought would develop 40,000 HP. at a cost of $125,000.

NEW DULUTH, MINN.—The council has granted a franchise to Hurd & Son, of the Hurd Refrigerator Co., for an electric light plant of 20 to 50 arc lights and probably incandescent lights estimated to cost about $3,000.

SABULA, IA.—It is reported that an electric light plant is to be constructed as soon as the water-works now being built are completed.

MALVERN, ARK.—It is reported that this place will be lighted by electricity.

VAN BUREN, ARK.—Bids are asked for constructing an electric light plant, according to reports. C. W. Miller.

HEMPSTEAD, TEX.—It is reported that an electric light plant will be put in at this place.

MONTEREY, CAL.—A company has been incorporated with a capital stock of $100,000, which proposes to construct a flume, 1¼ miles in length, to bring water to this city for power purposes. David Roderick, J. S. Metteer and P. P. Dandridge are interested.

SEBASTOPOL, CAL.—It is reported that an electric light plant will be put in at this place next year.

WINNIPEG, MAN.—Bids are asked until Jan. 23 for the purchase of a gas and electric light franchise. D. W. Bole, Chn. Com.

NEW COMPANIES.—Standard Electric Co., Philadelphia, Pa.; $1,000; Treas., J. A. Goodfellow, 128 Race St.

Suburban Light & Water Co., Wheeling, W. Va.; $500,000; A. Rolf, L. F. Stifel and P. O. Reymanu.

Cardington Electric Light & Power Co., Cardington, O.; $15,000; M. J. Carmack, E. T. Bowen, E. H. Fishack.

Potomac Light & Power Co., Georgetown, D. C.; $35,000; A. W. Wilder, V. M. Watkins, St. Paul, Minn.; G. A. King, Washington.

Branford Water, Light & Power Co., Branford, Conn.; a dam will be constructed about a mile from town; Pres., F. W. Allderige; Secy., E. F. Bennett; Treas., F. W. Giddings.

Stockton Gas & Efectric Co., San Francisco, Cal.; $1,000,000; August Muenter, Stockton; Edward du Barry, Oakland; C. L. Green, R. M. Welsh, E. R. Taylor, San Francisco.

Electro-Magnetic Machine & Mining Co., Milwaukee, Wis.; $6,000; Frederick Weinhagen. William Hinrichs, C. A. Rhode. Phoenix Light & Fuel Co., Phoenix, Ariz.; $150,000; E. C. Root, J. A. Fleming, T. W. Hine.

Conewago Water & Power Co., Columbia, Pa.; $20,000; to operate the water power of the Susquehanna River, at Falmouth, Chickies or Wrightsville; Treas., W. H. Boyer, 1215 Filbert St., Philadelphia.

GARBAGE DISPOSAL.

BRIDGEPORT, CONN.—The board of charities has decided that the garbage shall not be collected by the attendants at the town farm after the expiration of the present contract, and it is reported probable that next spring the council will consider the question of a crematory.

BROOKLYN, N. Y.—Bids are asked until Dec. 24 for the construction of a garbage and refuse crematory at the navy yard. Address E. O. Matthews, Ch. of Bureau of Yards and Docks, Washington, D. C.

PHILADELPHIA, PA.—Contracts for collecting and disposing of the city garbage during 1895 have been awarded at $252,140. The bids are published under Contract Prices.

ST. PAUL, MINN.—Bids are asked until Dec. 12 for the collecting and cremating of garbage, nightsoil, dead animals, etc., for ten months from March 1. It is probable that two 50-ton crematories will be erected, as noted last week. Thos. A. Prendergast, Cy. Clk.

MONTREAL, QUE.—The health committee has prepared a report asking the council to purchase two additional Thackeray garbage incinerators, similar to the one already in use, which was described in our issue of last week. The incinerators are reported to cost $39,000 each. L. O. David, Cy. Clk.

MISCELLANEOUS CONTRACTS AND SUPPLIES.

JAIL.—Atlanta, Ga.—An election will be held in this county Jan. 2 to vote on an issue of $150,000 in bonds for a new jail.

TIMBER.—Montreal, Que.—Bids are asked until Dec. 18 for supplying timber and deals for 1895. Alex. Robertson, Secy Harbor Comrs.

DRAINAGE DITCH.—Orland, Ill.—Bids are asked until Dec. 22 for excavating about 4,620 ft. of ditch in this town. Harry Cox, Clk. Comrs.

FIRE ENGINE.—New York, N. Y.—Bids are asked by the fire department until Dec 12 for furnishing one third size steam fire engine, with La France boiler.

DREDGING.—Rock Island, Ill.—Bids are asked until Dec. 28 for dredging in Quincy Bay, Ill., as stated in our advertising columns. Maj. A. Mackenzie, U. S. Engr. Office.

MONUMENTS.—Ottawa, Ont.—Bids are asked until Dec. 18 for the erection of a monument at Chateauguay, Que., and at Lundy's Lane, Ont. Capt. A. Benoit, Secy. Dept. Militia.

BRICK WALL.—Roanoke, Va.—Bids are asked until Dec. 18 for the construction of a brick wall on a foundation of concrete to be built for the city in Lick Run drain. Wm. M. Dunlap, Cy. Engr.

CEMENT, STONE, ETC.—Wilmington, N. C.—Bids are asked until Jan. 7 for furnishing and delivering at Fort Caswell, N. C., cement, broken stone, rubble stone, and sand for concrete masonry. Maj. W. S. Stanton, U. S. Engr. Office.

TELEPHONE LINE.—South McAlester, Ind. T.—Geo. S. Good & Co. will erect a telephone line as soon as possible between this city and Oklahoma City, 122 miles, along the route of the Choctaw, Oklahoma & Gulf Ry., now under construction.

TORPEDO BOATS.—Washington, D. C.—Bids are asked by the navy department for the construction of three torpedo boats, for which there is an appropriation of $450,000. These vessels will be of the same general type as the "Ericsson" and must make a speed of 24.5 knots.

BORING AND HIRE OF DREDGE.—Buffalo, N. Y.—Bids are asked until Dec. 27 for making test borings on line of Buffalo breakwater to Stony Point, and until Dec. 31 for hire of dredging plant on improvement of Tonawanda Harbor and Niagara River. Maj. E. H. Ruffner, U. S. Engr. Office.

STONE AND BRICK WORK.—Kansas City, Mo.—Bids are asked until Dec. 28 for stone and brick work of the superstructure of the U. S. public building in this city, as stated in our advertising columns. Address Chas. E. Kemper, Acting Supervising Architect, Treasury Dept., Washington, D. C.

MONUMENT.—Harrisburg, Pa.—Press reports state that C. Day Rudy, Pres. Sixteeners Club, representing 15,000 graduates of the Soldiers' Orphans' schools of Pennsylvania, has announced the appointment of committees to arrange for the erection of a monument in Capital Park by the Sixteeners to the memory of the late ex-Gov. Curtin. The monument is to cost $415,000, and will be erected by contributions from the Sixteeners alone. Secy. and Treas. of Com., Frank W. Smith, Philadelphia.

BUILDINGS.—Buffalo, N. Y.—The contract for building a large addition to the Alabama flats, on Delaware Ave., has been let to the Cockburn Bros. Co., Agt. for the Ransom Smith Co., of Chicago, at $160,000. Considerable iron will be used in the construction. Charles L. Sherrill is the wner.

Buffalo, N. Y.—An 11-story building, constructed of steel with curtain walls of terra cotta and brick, estimated to cost $240,000, is projected on the site of the present Spalding Exchange. Frank M. Roberts, Arch., has prepared the plans.

Baltimore, Md.—Bids are asked until Dec. 10 for the erection of a new city college building on North Howard St., also for heating apparatus and plumbing and gas fitting for said building. Archs., Baldwin & Pennington, 44 South St.

Atlanta, Ga.—Bids are asked until Dec. 18 for the superstructure of the manufactures, machinery, agricultural, electricity and forestry buildings for the exposition. Plans and specifications are on file at the company's office, and at the offices of Bradford L. Gilbert in the Equitable building, Atlanta; the Auditorium Tower, Chicago; the Ames building, Boston, and the Tower building, New York. Grant Wilkins, Chief of Construction.

Des Moines, Ia.—Contracts for the new Fullerton building and the Baptist church in this city have been awarded to Crellin & Lovell, Engrs. and contractors, of Des Moines.

STREET CLEANING.—Philadelphia, Pa.—The following contracts have been awarded for street cleaning for the coming year: Wilson & Vare, district No. 1, at $88,907; Thos. Parker, district No. 2, at $155,700; Geo. A. Vare, district No. 3, at $34,989, and No. 5, at $74,991; T. Dorney, Son & Co., district No. 4, at $104,974; Geo. W. Ruch, cleaning Broad St., $44,000.

DEEP WATER.—San Antonio, Tex.—Press reports state that the contract was signed in this city Nov. 27 by the Aransas Harbor Co. and Brewster Cameron, contractor, of Pennsylvania, for securing deep water at Aransas Pass. The company represented by Mr. Cameron is to receive a bonus of $600,000 in land when 20 ft. of water over the bar is secured.

CANALS.—Fresno, Cal.—Press reports state that active steps are being taken to secure the early construction of the proposed canal to tidewater by way of the San Joaquin River. The plan is to build as much of the canal as possible by farmers who have teams to spare. They will take their pay in script and this script will be accepted as payment for the charges on the canal at the rate of $1 per ton from Fresno to Port Costa. The route of the canal is made public for the first time between this city and Fresno slough. The right of way has not been secured the entire distance, but most of it is guaranteed. Work on it has been proceeding quietly for some time, and complete maps have been made.

Winter Haven, Fla.—Bids are asked by F. W. Inman, according to reports, for the excavation of a navigable canal to connect several lakes near Winterset.

CONTRACT PRICES.

SHEAR LEGS.—Washington, D. C.—The following bids were received Nov. 26 for furnishing 100-ton shear legs for the League Island navy yard:

Wm. Seller & Co., Philadelphia	$25,650
Philadelphia Engr. Wks., Ltd., Philadelphia	22,800
Phoenix Iron Co., Philadelphia	35,426
Weimer Machine Wks., Lebanon, Pa.	27,936
Kilby Mfg. Co., Cleveland, O.	29,695
S. C. Forsaith Machine Co., Manchester, N. H.	25,900
Tacony Iron & Metal Co., Tacony, Pa.	21,990
Morgan Engineering Co., Alliance, O.	28,618
John Baizley, Philadelphia	33,474
New Jersey Steel & Iron Co., Trenton, N. J.	20,553
J. P. Morris Co., Philadelphia,	27,675
Andrew H. Haig, Philadelphia,	24,000
*F. W. Wood, Receiver, Maryland Steel Co.	34,200
Camden Iron Wks., Philadelphia	28,400

* Sparrow's Point, Md.

PUMPING ENGINE.—Allegheny, Pa.—Robt. Swan, Engr., writes us that the following bids were received Nov. 28 for three 12,000,000-gallon pumping engines:

Wm. Cramp & Sons, Philadelphia, Pa.	$220,000
*Groshon High-Duty Pumping Engine Co.	177,000
Holly Mfg. Co., Lockport, N. Y.	185,785
Wilson, Snyder Mfg. Co., Pittsburg, Pa.	231,990
E. P. Allis Co., Milwaukee, Wis.	$180,000 and 220,000
H. R. Worthington, Brooklyn, N. Y.	197,750
Snow Steam Pump Co., Buffalo, N. Y.	198,000

* New York, N. Y.

WATER-WORKS.—Union City, O.—Chas. Suma, Clk. (P. O., Union City, Ind.), writes us that the contract for works has been virtually awarded to the Knapp Supply Co., on its three bids amounting to $8,599 for the complete plant. The bids were as follows:

For 280 tons of pipe and 6 tons of special castings.

Ohio Pipe Co., Columbus, O.	$5,260
Addyston Pipe & Steel Co., Cincinnati, O.	5,576
Radford Pipe & Foundry Co., Radford, Va.	5,267
Knapp Supply Co., Union City, Ind.	5,140
J. B. Clow & Son, Chicago, Ill.	5,520
Lake Shore Foundry Co., Cleveland, O.	5,504
Anniston Pipe & Foundry Co., Anniston, Ala.	5,435
Ripley Detrick Supply Co., St. Louis, Mo.	5,402

For 30 fire hydrants and 24 valves and boxes.

	Hydrants.	Valves & boxes.
J. B. Clow & Son, Chicago, Ill.	$750.00	$317.00
*Rensselaer Mfg. Co., Chicago, Ill.	.....	290.00
Crane & Co., Chicago, Ill.	690.00	270.00
Ludlow Valve Mfg. Co., Troy, N. Y.	670.50	304.00
Knapp Supply Co., Union City, Ind.	690.00	256.00
**Bourbon Copper & Brass Works.	777.00	288.00

* O. Jones, Agent. ** Cincinnati, O.

Pipelaying, 4-in., 7,900 ft.; 6-in., 7,132 ft.; 8-in., 3,545 ft.; setting valves and hydrants.

Boughen Engineering Co., Cincinnati, O.	$2,978
Jacob Neibert, Dayton, O.	2,803
Sykes & Wagner, Minneapolis, Minn.	3,068
Kerlin Bros., Toledo, O.	2,513
H. O. Jackson, Union City, Ind.	2,901
Taft & Dole, Columbus, O.	2,819
W. H. & G. E. Wallingford, Newport, Ky.	2,470
Louis Mayer, Lancaster, O.	*2,816
Knapp Supply Co., Union City, Ind.	2,513

For complete plant.

Chas. A. Starkey, Belleville, Ill.	$8,751
Caruthers & Crane, Cincinnati, O.	9,050
H. Merrigold, Lima, O.	9,500
A. F. Nims, Elkhart, Ind.	10,973
Andrews & Shields, Hamilton, O.	9,063
Knapp Supply Co. (three separate bids).	8,599

Arlington Heights, O.—J. T. Hall, Clk., writes us that the contract for works has been awarded to Crane & Co., at $3,250 for a complete plant. The itemized bids were as follows:

Bids Received at Arlington Heights, O., for Constructing Water-Works.

	Pipe 6-in.	Pipe 4-in.	Specials.	Valves, 6-in.	Valves, 4-in.	Boxes.	Hydrants.	Pipelaying, 6-in.	Pipelaying, 4-in.
Rensselaer Mfg. Co., Troy, N. Y.	....	....	..	$11.20	$6.88	$2.75	....	..	..
W. N. Air, Newport, Ky.	$18.60	$18.60	$0.02½	10.75	6.65	2.80	$24.00	$0.12	$0.14
Reed & Wingfield, Cincinnati, O.	18.60	18.60	.02½	10.75	6.65	2.80	24.00	.14½	.13
W. H. & G. C. Wallingford, Newport, Ky.	....	....	..	....	....	....	....	.13½	.11½
Anniston Pipe & Foundry Co., Cincinnati	18.60	18.60	.02½	....	....	....	....	..	..
Bourbon Copper & Brass Wks., Cincinnati	....	....	..	10.75	6.65	2.80	24.00	..	..
Van Sandt, Meeds & Smith, Cincinnati.	19.65	19.65	.02¾	11.13	6.90	3.00	26.00	.13	.15
Chapman Valve Mfg. Co., Chicago, Ill.	....	....	..	12.85	8.33	....	20.75	..	..
Ryan & Co., Reading, O.	....	....	..	9.50	6.00	2.50	23.00	.11¾	.10½
Hesterberg & Co., Cincinnati, O.	....	....	..	9.50	6.00	2.50	23.00	..	..
Crane & Co., Cincinnati, O.	....	....	..	10.75	6.65	2.80	24.00	.15½	.12½

Little Rock, Ark.—The contract for a water supply system at the new military fort near this city has been awarded to T. J. Prosser, at 47 cts. per ft. for furnishing and laying 60 ft. of 3-in. cast iron pipe, 51 cts. for 3,100 ft. of 4-in., and 73 cts. for 3,200 ft. of 6-in. pipe. The total bids were as follows:

T. J. Prosser, St. Louis, Mo.	$3,945
Campbell & Harrison, Richmond, Ind.	5,399
Nick Peay Co., Little Rock, Ark.	4,863
Foley Bros. & Guthrie, St. Paul, Minn.	5,488
Zeb Ward, Jr., Little Rock, Ark.	4,485
Zeigler & Dalton, Junction City, Kan.	4,418
Chas. A. Moses, Chicago, Ill.	4,827
Mockler & Fullerton, St. Louis, Mo.	4,948
John B. Hendrey, Denver, Colo.	7,469
Moses P. Keefe, Omaha, Colo.	8,415
Anderson Bros., St. Louis, Mo.	5,176

SEWERS.—Newark, N. J.—The following contracts were awarded Nov. 22: Monroe St. sewer, Headley & Christie, 15-in. pipe, 59 cts.; 12-in., 42 cts.; basins, $76; manholes, $25; Columbia St. sewer, Chas. O'Connor, 12-in. pipe, 55 cts.; 10-in., 43 cts.; basins, $93; manholes, $24; Niagara St. sewer, Headley & Christie, 12-in., 43 cts.; 10-in., 47 cts.; basins, $76; manholes, $25.

Little Rock, Ark.—The contract for constructing the sewer system at the new military post near this city has been awarded to T. J. Prosser, at the following prices: 6-in. sewer pipe in place, 2,800 ft., 28 cts. per ft.; 8-in., 2,400 ft., 34 cts.; 10-in., 8,100 ft., 47 cts.; 10-in. cast iron pipe, 420 ft., $1.13; butt piles in place, 21, $15 each; manholes, 40, $35 each; 6-in., 8-in. and 10-in. manholes, 10 of each, $5 each; stone piers, 4, $5 per cu. yd. The total bids were as follows:

L. L. Leach & Sons, Chicago, Ill.	$11,632
T. J. Prosser, St. Louis, Mo.	7,757
Campfield & Harrison, Richmond, Ind.	11,306
Nick Peay Co., Little Rock, Ark.	10,635
Foley Brothers, St. Paul.	10,188
Makler, Fullerton & Co., St. Louis.	11,530
Zeb Ward, Jr., Little Rock, Ark.	9,715
P. McDonald, Kansas City.	16,080
Zeigler & Dalton, Junction City, Kan.	10,536
Chas. A. Moses, Chicago, Ill.	8,806
John J. Hendrey, Denver, Colo.	7,021
Lipsett & Cregg, Sault Ste. Marie, Mich.	7,995
Moses P. Keefe, Omaha, Neb.	18,424
Gillick Brothers, St. Louis, Mo.	15,542
J. McCappin, Little Rock, Ark.	8,691
Anderson Brothers, St. Louis, Mo.	9,820
J. H. McCarthy, Little Rock, Ark.	8,497

GARBAGE DISPOSAL.—Philadelphia, Pa.—Bids for the collection and incineration of the garbage of the city for the coming year were opened Nov. 26. The specifications require that the successful bidders shall have their plants ready for operation by Jan. 1. The garbage is to be collected 6 times each week, between 6 a. m. and 5 p. m., and conveyed through the streets in metal carts. Dead animals must be removed within three hours after discovery. Jas. H. Windrim, Dir. Pub. Wks., writes us that the bids were as follows:

	District No. 1.	2.	3.	4.	5.
Amer. Incin'ting Co.	*$40,890	$67,200	*$26,000	$78,000	$84,900
Wells Incin'ting Co.	49,950	54,450	27,000	*63,350	*58,000
C. S. Fuel Co., by Theo. Tooney	58,000	*54,000	30,000	68,000	60,000
Peoples & Josephs	68,993	57,999	....	78,000	63,999
K. & D. Dooley	....	....	27,900	....	....
Geo. W. Ruch	....	....	....	83,000	....
T. Dorney, Son & Co.	....	....	....	83,000	....
Wilson & Vare	....	....	....	....	74,989

* Awarded contract, according to the "Press."

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work.	Place.	See Eng. News.
Dec. 7.	Water bonds,	New Bedford, Mass.	Nov. 22
Dec. 7.	Safety gates,	Brooklyn, N. Y.	Nov. 22
	Advertised, Eng. News, Nov. 22.		
Dec. 7.	Pipe sewers,	Fort Wayne, Ind.	Nov. 29
Dec. 7.	Pipe sewers,	Utica, N. Y.	Dec. 6
Dec. 7.	Asphalt paving,	Washington, D. C.	Dec. 6
Dec. 7.	Pipe line (14,000 ft.),	Monrovia, Cal.	Dec. 6
Dec. 8.	Water bonds ($4,000),	Rushford, Minn.	Nov. 22
Dec. 10.	Breakwater extension,	Buffalo, N. Y.	Nov. 8
	Advertised, Eng. News, Nov. 8 to 29.		
Dec. 10.	Water bonds ($100,000),	Steubenville, O.	Nov. 15
Dec. 10.	Electric lighting,	Millville, N. J.	Nov. 15
	Advertised, Eng. News, Nov. 15 and 22.		
Dec. 10.	Water bonds ($6,110),	Montevideo, Minn.	Nov. 22
Dec. 10.	Removing wreck,	Wilmington, Del.	Nov. 22
Dec. 10.	Bridge superstructure,	Warren, O.	Nov. 22
Dec. 10.	Pier work,	Duluth, Minn.	Nov. 22
Dec. 10.	Irrigation works,	Fresno, Cal.	Nov. 29
Dec. 10.	Air-pump and jet condenser,	Cleveland, O.	Nov. 29
Dec. 10.	Cast iron pipe,	Washington, D. C.	Nov. 29
	Advertised, Eng. News, Nov. 29.		
Dec. 10.	Sewer,	Perth Amboy, N. J.	Nov. 29
Dec. 10.	Deep well pumps,	McKeesport, Pa.	Dec. 6
Dec. 10.	College building,	Baltimore, Md.	Dec 6
Dec. 10.	Grading, St. Paul,	Minn.	Dec. 6
Dec. 10.	Repairs to p'mp'g eng.,	Madison, Ind.	Dec. 6
Dec. 10.	Pipe sewer,	Fargo, N. Dak.	Dec. 6
Dec. 11.	Island protection,	Richmond, Va.	Nov. 22
	Advertised, Eng. News, Nov. 22 and 29.		
Dec. 11.	Covering steam pipes,	Washington, D. C.	Nov. 29
	Advertised, Eng. News, Nov. 29 to Dec. 13.		
Dec. 11.	Rock excav. for water pipe,	Buffalo, N. Y.	Nov. 29
Dec. 11.	Steel rods for bridge,	Buffalo, N. Y.	Dec. 6
Dec. 12.	Electric lights,	Cleveland, O.	Nov. 22
Dec. 12.	Street cleaning,	Cleveland, O.	Nov. 22
Dec. 12.	Oil lamps (4,377),	Cleveland, O.	Nov. 22
Dec. 12.	Rock excavation,	New York, N. Y.	Dec. 6
Dec. 12.	Fire engine,	New York, N. Y.	Dec. 6
Dec. 12.	Garbage crematories,	St. Paul, Minn.	Dec. 6
Dec. 13.	Bridge superstructure,	Scranton, Pa.	Nov. 22
Dec. 13.	Dike,	Philadelphia, Pa.	Nov. 22
Dec. 13.	Water-wks system,	Monroe, N. Y.	Nov. 22
	Advertised, Eng. News Nov. 22 to Dec. 6.		
Dec. 14.	Tunnel,	Cleveland, O.	Nov. 22
Dec. 15.	Surveying,	Flemington, N. J.	Nov. 22
	Advertised, Eng. News, Nov. 22.		
Dec. 15.	Iron tanks for sale,	Burlington, N. J.	Dec. 6
	Advertised, Eng. News, Dec. 6 and 13.		
Dec. 17.	Wooden bridge,	Franklin, Neb.	Nov. 8
Dec. 17.	Lumber and stone,	Sioux City, Ia.	Nov. 29
Dec. 17.	Water bonds	Fort Collins, Colo.	Nov. 29
Dec. 17.	Paving,	Houston, Tex.	Dec. 6
Dec. 18.	Telephone system,	Washington, D. C.	Nov. 22
Dec. 18.	Artesian well near	San Marcos, Tex.	Nov. 29
	Advertised, Eng. News, Nov. 29 to Dec. 13.		
Dec. 18.	Constructing water-wks.,	Newton, N. J.	Nov. 8
	Advertised, Eng. News, Nov. 8 and 15.		
Dec. 18.	Pipe sewers,	Buffalo, N. Y.	Dec. 6
Dec. 18.	Brick wall,	Roanoke, Va.	Dec. 6
Dec. 18.	Buildings,	Atlanta, Ga.	Dec. 6
Dec. 18.	Water bonds ($100,000),	Portland, Ore.	Dec. 6
Dec. 18.	Timber,	Montreal, Que.	Dec. 6
Dec. 18.	Monuments,	Ottawa, Ont.	Dec. 6
Dec. 20.	Brick sewers,	San Antonio, Tex.	Nov. 22
	Advertised, Eng. News, Nov. 22 to Dec. 13.		
Dec. 20.	Pipe sewers,	San Antonio, Tex.	Nov. 22
	Advertised, Eng. News, Nov. 22 to Dec. 13.		
Dec. 20.	Sewer pipe, brick, etc.,	San Antonio, Tex.	Nov. 22
	Advertised, Eng. News, Nov. 22 to Dec. 13.		
Dec. 20.	Pipe sewers (26,185 ft.),	Pittston, Pa.	Nov. 29
	Advertised, Eng. News, Nov. 29 to Dec. 13.		
Dec. 20.	Elevator at	Duluth, Minn.	Nov. 29
Dec. 20.	Brick sewers (3,720 ft.),	Pittston, Pa.	Nov. 29
	Advertised, Eng. News, Nov. 29 to Dec. 13.		
Dec. 20.	Pipe, 40-in.,	Cambridge, Mass.	Dec. 6
	Advertised, Eng. News, Dec. 6 and 13.		
Dec. 20.	Steam engines,	Washington, D. C.	Dec. 6
Dec. 20.	Water bonds	New Paynesville, Minn.	Dec. 6
Dec. 20.	Pipe, 30-in. (15,000 ft.),	Dallas, Tex.	Dec. 6
Dec. 21.	Dredging, St.	Augustine, Fla.	Nov. 29
Dec. 22.	Drainage ditch,	Orland, Ill.	Dec. 6
Dec. 24.	Street imp'v't bonds,	Madisonville, O.	Nov. 29
Dec. 24.	Concrete wall, etc.,	Brooklyn navy yard.	Nov. 29
Dec. 24.	Garbage cremat'y at	Brooklyn navy yd.	Dec. 6
Dec. 24.	Bridge superstructure,	Cincinnati, O.	Dec. 6
Dec. 26.	Electric lighting,	Monroe, Mich.	Nov. 15
Dec. 27.	Borings,	Buffalo, N. Y.	Dec. 6
Dec. 27.	Sewer,	Washington, D. C.	Dec. 6
	Advertised, Eng. News, Dec. 6 to 20.		
Dec. 28.	Dredging, Rock Island,	Ill.	Dec. 6
	Advertised, Eng. News, Dec. 6 to 27.		
Dec. 28.	Stone and br'k w'k at	Kansas City, Mo.	Dec. 6
	Advertised, Eng. News, Dec. 6 and 13.		
Dec. 29.	Sewer system,	Fortress Monroe, Va.	Dec. 6
	Advertised, Eng. News, Dec. 6 to 27.		
Dec 31.	Hire of Dredging plant,	Buffalo, N. Y.	Dec. 6
Jan. 7.	Cement, stone, etc.,	Wilmington, N. C.	Dec. 6
Jan. 7.	Water bonds,	Detroit, Mich.	Nov. 15
Jan. 23.	Electric light franchise,	Winnipeg, Man.	Dec. 6
Jan. 23.	Gas franchise,	Winnipeg, Man.	Dec. 6
Feb.	Steel bridge,	Natchitoches, La.	Dec. 6
No date.	Railway materials (20 miles) in	Texas.	Dec. 6
" "	Electric light plant,	Van Buren, Ark.	Dec. 6
" "	Canal excavations,	Winter Haven, Fla.	Dec. *

INDUSTRIAL NOTES.

THE SCHULTZ BRIDGE & IRON CO., of Pittsburg, Pa., has the contract for the new South bridge at $390,750. The bids were published last week.

THE UNION FOUNDRY & CAR WHEEL WORKS, of Pullman, Ill., had the pattern shop destroyed by fire Nov. 28, involving a loss of some $30,000.

MR. WILLIAM GALLOWAY'S ornamental terra cotta works at Walnut and 33d Sts., Philadelphia, Pa., were burned Nov. 28, involving a loss of about $100,000.

THE NATIONAL SWITCH & SIGNAL CO., Easton, Pa., has received an order from the Lake St. Elevated R. R. of Chicago, for three interlocking machines having respectively 9 levers, 2 levers and 2 levers.

RITER & CONLEY, of Pittsburg, Pa., have a contract from the Bettendorf Metal Wheel Works, of Davenport, Ia., for the construction of a shop 70 × 340 ft., with walls 18 ft. high and a monitor roof. There will also be a wing 64 × 68 ft.

THE WASHINGTON BRIDGE CO., of Tacoma, Wash., has been reorganized, and the following officers elected: Pres., G. N. Parker, St. Paul, Minn.; Vice Pres., H. W. Topping, St. Paul; Man., J. F. Howson, Tacoma; Secy., C. S. Milliken, Tacoma.

STEEL WORKS.—It is stated that the syndicate of St. Louis capitalists that purchased the Depauw steel rail works, at New Albany, Ind., will move the New Albany plant and the St. Louis plant to Alexandria. The three are to be consolidated, and will make one of the largest concerns of the kind in the United States, employing over 1,000 men.

THE INTERNATIONAL STEEL POST CO., St. Louis, reports a very heavy demand for its posts. It is supplying the C., C., C. & St. L. Ry. and has sold them many miles of these posts. Recent tests in operating these posts show that they can place in position 38 of the International steel posts while holes are being dug for two of the old style wooden posts.

THE RHODE ISLAND LOCOMOTIVE WORKS has received from the New York, New Haven & Hartford R. R. an order for 25 "Consolidated" type locomotives. These engines will have four pairs of 51-in. driving wheels, 20 × 26-in. cylinders and each will weigh 150,000 lbs., with 138,000 lbs. on the drivers. The boilers will be 72 ins. in diameter. The entire order means an expenditure of about $250,000.

THE TAUNTON LOCOMOTIVE MFG. CO., of Taunton, Mass., reports sales of eleven of its nose and wing snowplows for electric railways including the following roads: Worcester, Leicester & Spencer; Wakefield & Stoneham; Fitchburg & Leominster; Dartmouth & Westport; Plymouth Co.; Abington & Rockland; Lewiston & Auburn, and the Shamokin & Mt. Carmel. We shall illustrate this plow shortly.

THE PENNEY-MYER CONSTRUCTION CO., Wainwright Bldg., St. Louis, Mo., has succeeded the Penney Surveying Co., and will hereafter conduct a general contracting business. Pres., W. W. Penney; Vice-Pres., J. B. Myers; Secy., J. K. Stone; Treas., B. F. Hammett. It is just completing an electric railway 14 miles long, connecting Kirkwood, Mo., with St. Louis, and an 11-ft. tunnel sewer, 44 ft. below the surface, at Carondolet, St. Louis.

THE STUPP BROS. BRIDGE & IRON CO., St. Louis, Mo., has more than tripled the capacity of its plant in the past two years, and now has a shop for highway work, one for architectural iron work, and one for girders, turntables, etc. It makes a specialty of highway bridges, and of turning them out on very short notice, by carrying a large stock of standards constantly on hand. Pres., George Stupp; Vice-Pres., Peter Stupp; Secy., Julius Stupp.

THE ABBOTT-GAMBLE CONTRACTING CO., 620 Chesnut St., St. Louis, Mo., has been incorporated to carry on a general contracting business. It recently completed a $38,000 paving and a $10,000 sewer contract at Belleville, Ill. On the completion of work the city council passed a resolution thanking it for the excellent manner in which the work was done. Pres., Fred. W. Abbott, Assoc. M. Inst. C. E., Assoc. M. Am. Soc. C. E.; Secy. and Treas., Hamilton R. Gamble.

JAMES STEWART & CO., St. Louis, Mo., have been awarded the following contracts: Building the new N. Y. C. & H. R. R. R. station at Syracuse, N.Y.; four bridges and an office building for the Catract Construction Co., Niagara Falls, N. Y.; the Peizer, S. C., mill, 600 × 250 ft., which will include the using of 6,200,000 brick and 3,000,000 ft. of timber; the freight and passenger station for the Air Line, at East St. Louis, Ill., and a 20-stall roundhouse for the Big Four R. R., at Malton.

THE SARGENT CO., of Chicago, Ill., has brought out a tire-dressing brakeshoe, which is said to be meeting with the approval of the trade, on account of its improved design and saving in first cost. The company states that owing to the great interest that is being taken in the brakeshoe question at the present time, it is hastening to lay before the railway people an improvement that effects a very considerable saving in expense. The new shoe is already in use as standard on a number of railways.

THE YOUNGSTOWN BRIDGE CO., of Youngstown, O., has been awarded the contract for the 38th St. bridge at Denver, Colo., which consists of two truss spans 48 ft. in width with three trusses, on tubular piers. This company has also recently been awarded the contract for a building for the new rolling mill of the Union Iron & Steel Co., at Youngstown, O.; and for some girder work for the New York, Lake Erie & Western R. R. The bids on the Denver bridge were given in our issue of Nov. 29.

THE DEAN BROS. STEAM PUMP WORKS, of Indianapolis, Ind., have commenced operations in their new plant. The shops are 55 ft. wide and extend for a length of about 1,000 ft. The buildings include a machine shop, iron foundry, brass foundry, pattern shop and woodworking shop. There are two traveling cranes in the machine shop, and steam cranes in the foundries. A system of narrow-gage tracks is led through the works. Power for the machinery and electric light plant is furnished by an Atlas engine.

THE COOK WELL CO., St. Louis, Mo., has recently been awarded the following contracts: Ashland, Wis., a complete system of wells; a complete system of water supply for the Crystal City Glass Co., Crystal City, Mo.; two wells for the Illinois Central R. R. at Champaign, Ill.; Conneaut, O., a system of wells similar to one at South Haven, Mich., recently illustrated in Eng. News; also for an 8-in. well, 350 ft. deep, for the Kansas City, Memphis & Birmingham R. R. at Amory, Miss. This company also has a general western agency for the Pohle air lift pump, and has had two of these pumps put in at Clinton, Ia.; one at Winnebago City, and one at Natchez, Miss.

THE FERNOLINE CHEMICAL CO., of Charleston, S. C., started this fall to investigate work done in 1885, '86 and '87, on which fernoline was used, and has found results so good that it has enlarged the capacity of its works in anticipation of the increased demand which is expected to follow. A typical illustration of the results found is the condition of track-stringers on the Enterprise and City horse railways, at Charleston, S. C., which were given two coats of fernoline when laid in 1886. These stringers when examined in 1894 were found to be perfectly sound and good; while uncoated stringers of the same quality, put in at the same time, were almost entirely gone. The results so far obtained show that fernoline doubles the life of timber at an increased cost in place of 5 to 6%.

NEW COMPANIES.—New Era Construction, Gas & Fuel Co., Newark, N. J.; $200,000, with $10,000 paid in; Percy Thompson, New York city; Franklin Noble, Jersey City.

Chicago Consolidated Iron & Steel Co., Chicago, Ill.; $500,000; G. B. Andrews, A. A. Oldfield and E. A. Briggs.

Blaine Ditching & Tile-Laying Machine Co., Alliance, O.; $20,000; Geo. E. Blaine, J. H. Johnson and R. S. Kayler.

Graff Contracting Co., Chicago, Ill.; $75,000; wrecking buildings; Chas. A. Lovell, Barnett Graff and John J. Healy.

American Smokeless Furnace Co., Cleveland, O.; $25,000; Luke F. Shinners, Charles B. Stowe and Henry C. Bunts.

Ingleton Mfg. Co., Pottstown, Pa.; $5,000, with $500 paid in; iron and steel pipe, etc. Treas., Chas. Schomel, 3,711 Locust St., Philadelphia, Pa.

Merced River Power & Water Co., San Francisco, Cal.; $1,000,000, with $50,000 paid in; G. A. Wulkop, Merced; F. C. Roberts and W. S. Morgan, San Francisco.

A. & P. Roberts Co., Philadelphia, Pa.; $1,000,000, with $100,000 paid in; iron manufacture and structural work. Treas., Jos. W. Davis, 261 South Fourth St., Philadelphia.

Springville Natural Gas Co., Springville, N. Y.; $20,000; to supply Collins and Concord; Michael McIntyre, Collins, N. Y.; Frank D. Smith and H. G. Leland, Springville.

Manhattan Arc Lamp Co., Jersey City, N. J.; $100,000, with $1,000 paid in; Wilfrid H. Fleming, Bayonne City, N. J.; S. M. Young, New York city; H. C. Blake, Stapleton, N. Y.

American Compressed Air Motor Co., New York city, $250,000, with $50,000 paid in; Jas. F. Lewis, Chicago, Ill.; F. A. Brainerd, Brooklyn, N. Y., and W. B. Dowd, New York city.

Universal Safety Filter Co., Jersey City, N. J.; $50,000, with $2,000 paid in; Albert P. Hyman, 25 Frankfort St., New York; S. P. Frankenstein, 110 Madison St., New York; Chas. H. MacDonald, Plainfield, N. J.

ADVERTISEMENTS.

WATER-WORKS FOR MONROE, N. Y.

Sealed proposals will be received until noon, Thursday, December 13th, 1894, by the Water Commissioners of the village of Monroe, Orange County, N. Y., for furnishing material and performing the labor necessary to construct complete, according to the plan and specification, the village water-works.

The work includes the furnishing of

630 tons of cast iron pipe 16 in. to 4 in diam.

7 tons of special castings.

5,000 feet of terra cotta pipe 15 in. diam.

40 fire hydrants and 40 valves and valve boxes and a 10-in. water meter.

Also the laying of

5,600 feet terra cotta pipe 15 in. diam.

36,360 feet of cast iron pipe and setting necessary hydrants and valves.

Also the construction of Gate House and Intake.

Bids shall be received separately for material and construction.

A certified check for 3 per cent. of the amount of bid must accompany each proposal.

The right is reserved to reject any or all bids.

Plans can be seen and specifications secured on and after December 1st at the office of the Water Commissioners or the offices of the engineers, 137 Broadway, New York, or 700 and 701 Lewis Block, Pittsburg.

POTTER & FOLWELL, Engineers.

GILBERT CARPENTER, Prest. } Board of
GEORGE R. CONKIN, Sect. } Water Comm.

47-3t

CREMATORY.

Detailed information wanted regarding garbage and sludge crematories.

PARKER N. BLACK,
47-1t and 49-1t Asbury Park, N. J.